ELECTRICAL REVIEW

For efficient, economical low speed drives—the N-S FREQUENCY CONVERTOR

The compact N-S Frequency Convertor has many applications in connection with the use of induction motors for very low speed drives or as multi-speed or variable speed machines, or to provide a low speed step for setting-up and similar operations. Among its advantages are reduction in capital costs and improved electrical performance.

Details of this machine and its uses will be given on request.

Gearless roller table motors, operating at 20 r.p.m., supplied at 2½ cycles from an N-S Convertor.

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NORWICH MANCHESTER LONDON AND BRANCHES

Examples of our many activities. The pump impeller is a Panilax Resin Moulding and is supported upon rolls of Mica tape and Empire tape. The punchings include Micanite, Paxolin Laminated and Mica.

m and i

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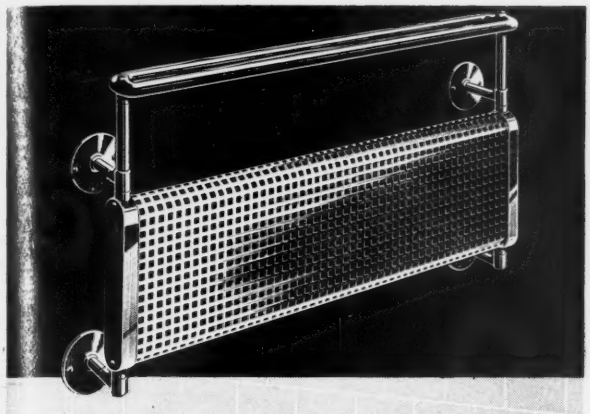

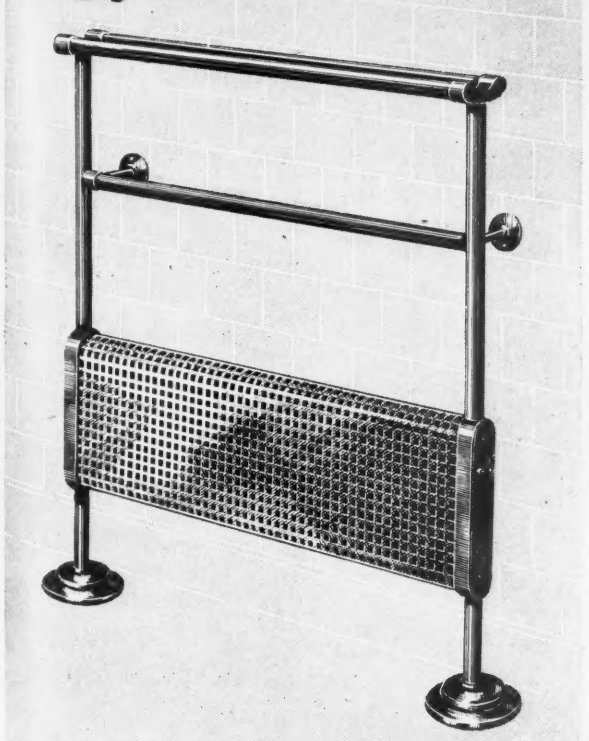

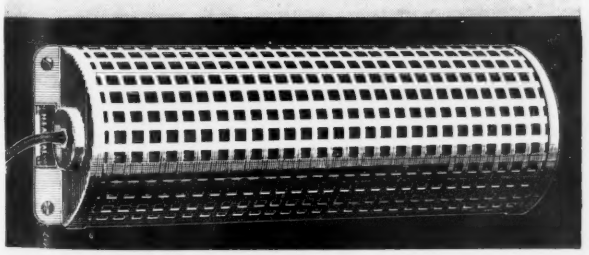

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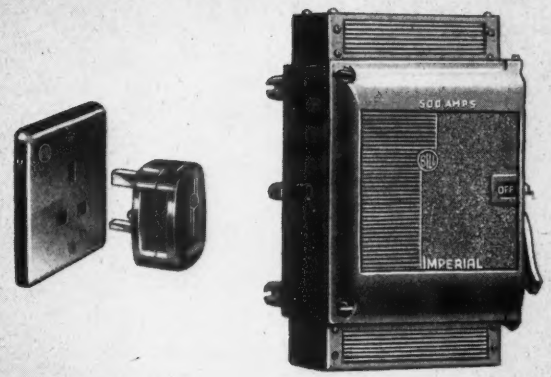

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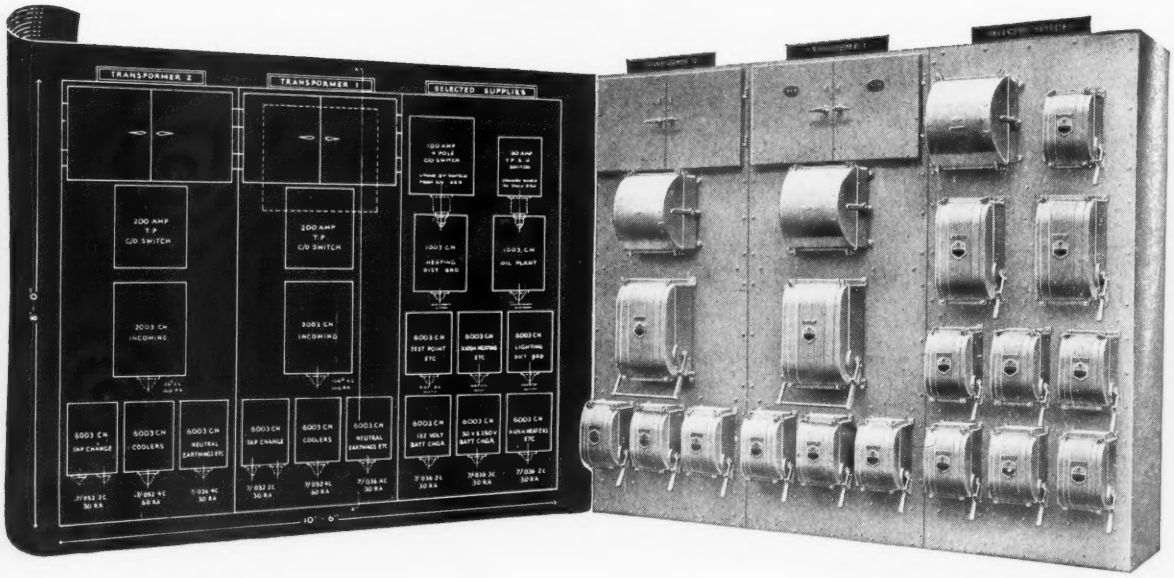

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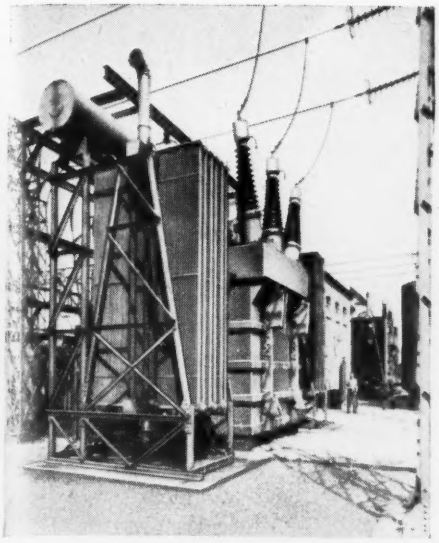
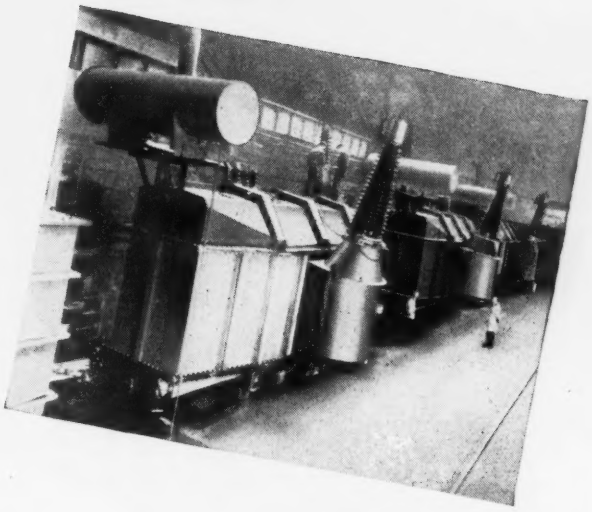
B T-H

Landmarks in Transformer Design



132-kV 1929



242-kV 1942

275-kV 1953

1929 132-kV, 15-MVA transformer supplied to the Central Electricity Board

1942 15.75/242-kV, 120-MVA, 3-phase bank of single-phase transformers supplied to USSR

1953 275-kV, 120-MVA transformer at Staythorpe — supplied to the British Electricity Authority.

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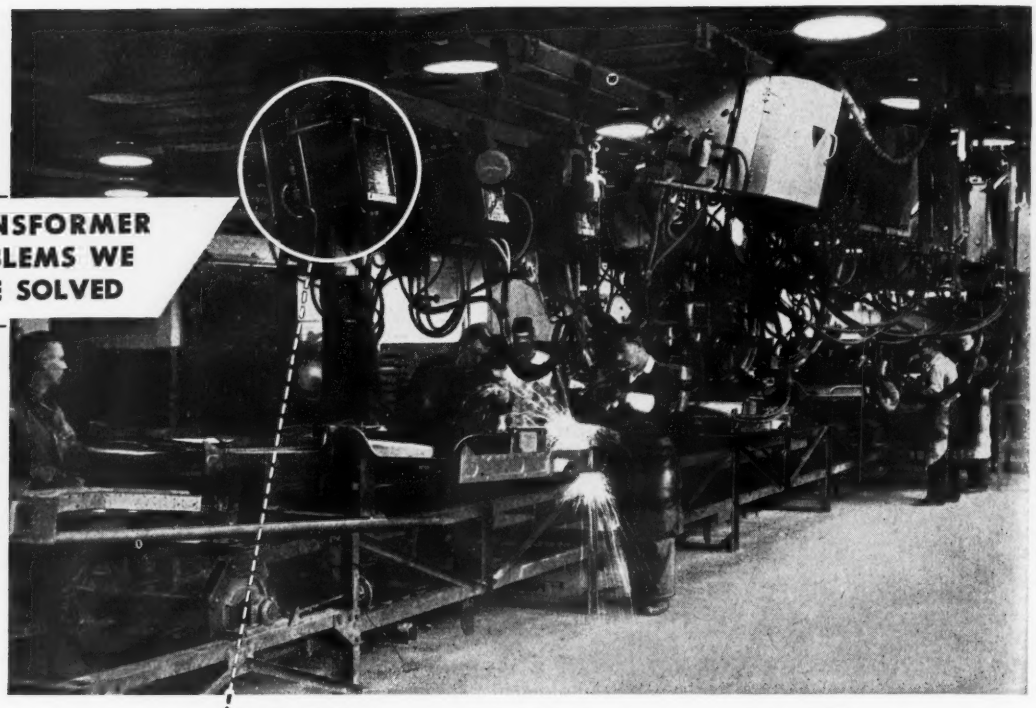
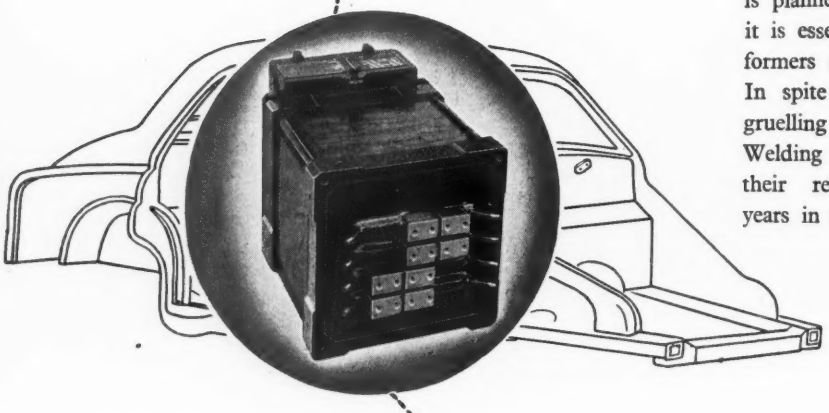


TRANSFORMER PROBLEMS WE HAVE SOLVED

Welding in the motor industry



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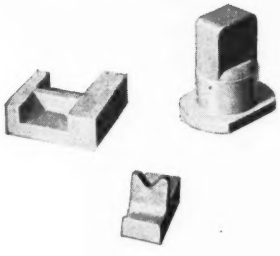
OR SMALL AND SIMPLE



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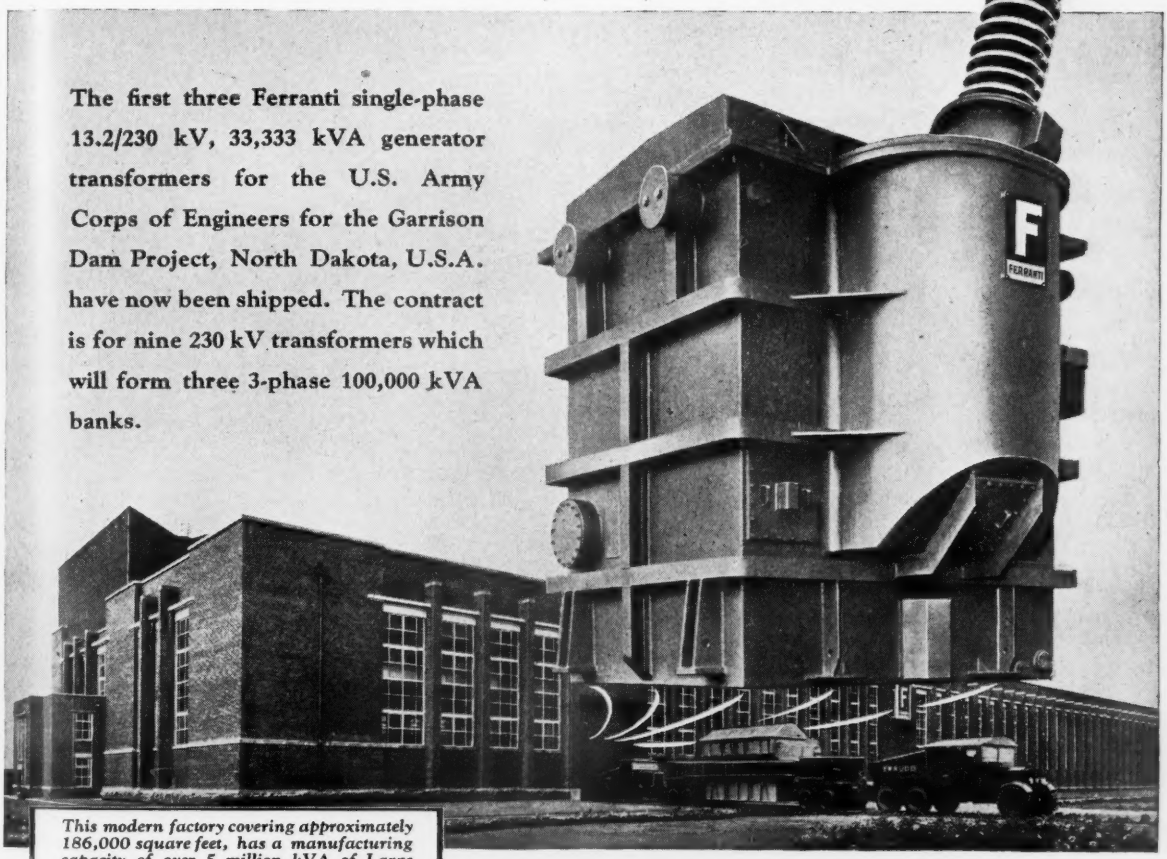

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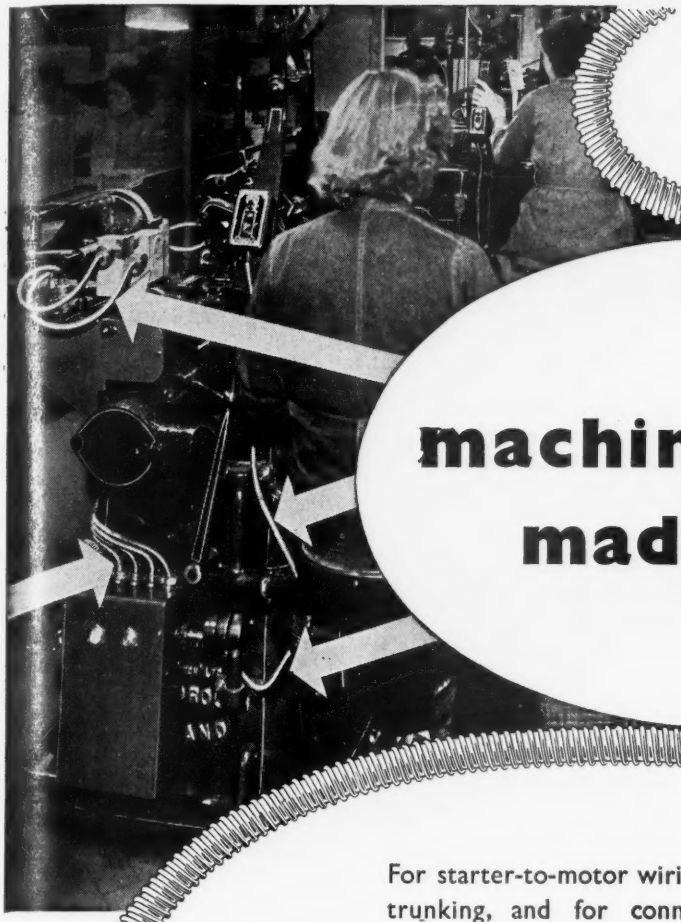

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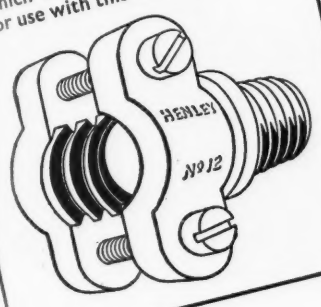

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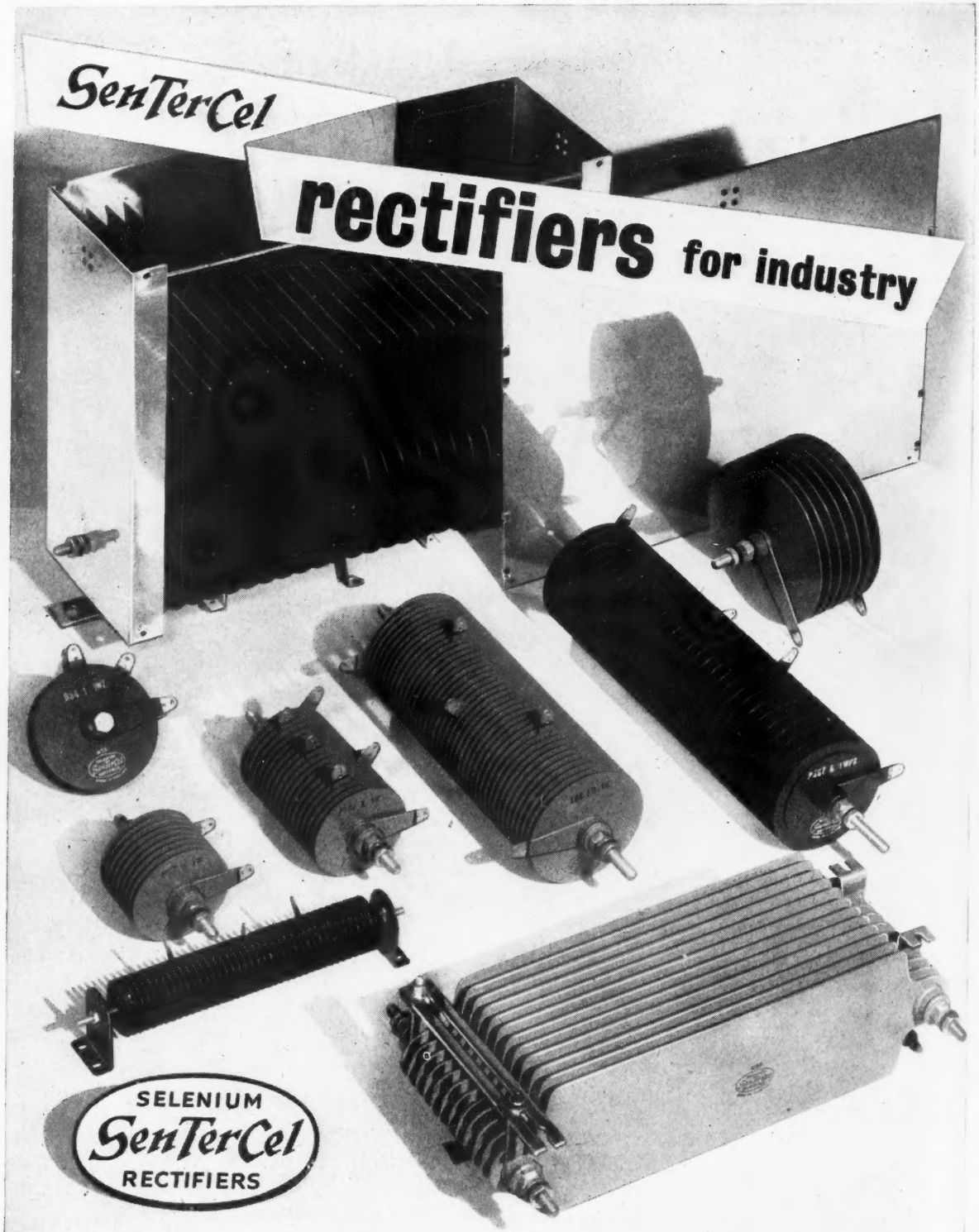

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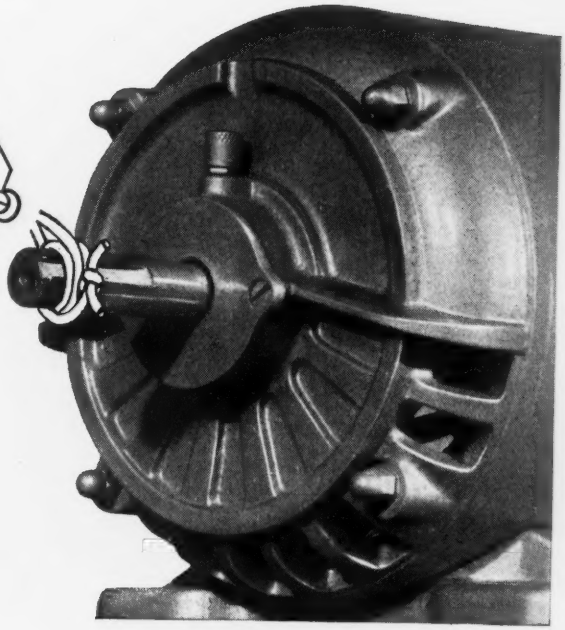

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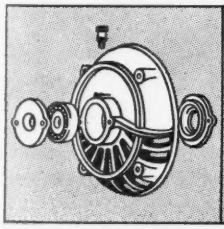	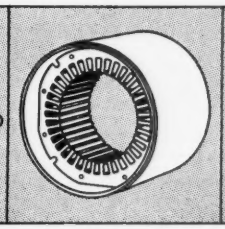	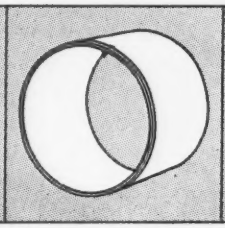	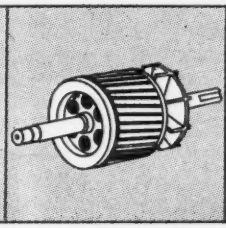	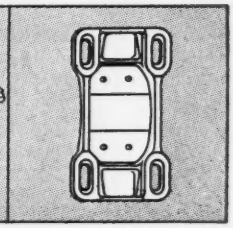
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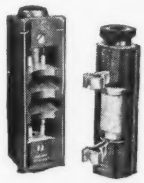

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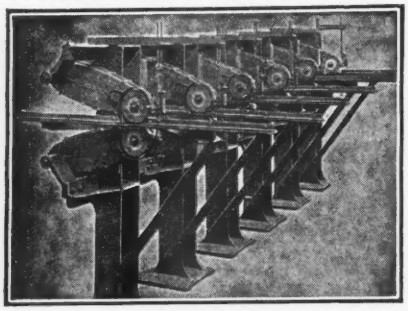

For removing the scale from 2 surfaces on one edge of plate simultaneously, preparatory to welding.

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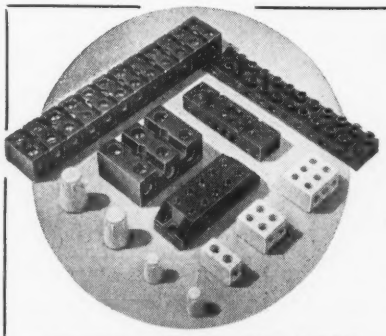

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MOULDED TERMINAL BLOCKS AND PORCELAIN CONNECTORS

These are fully described in our Catalogue No. NBL/2/ER

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Urea Moulding Materials

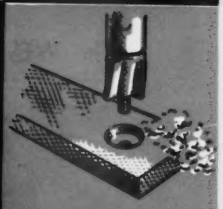
LIGHT WEIGHT

FLEXURAL STRENGTH

Alkyd Moulding Materials

Impregnated Papers and Fabrics

IMPACT STRENGTH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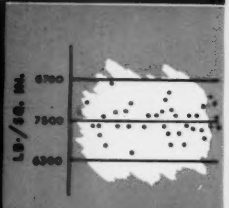

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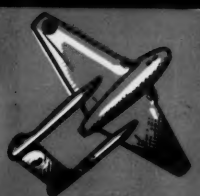
HIGH STRENGTH-WEIGHT RATIO

Polyester Resins

Here's the material— this is the job

Washing-machine agitators have to be light, strong and resistant to chemicals and hot water. That's why the two shown here were moulded from BAKELITE X13080 Black material. The agitator (top) was moulded by the Witton Moulded Insulation Works of the G.E.C. for the Wilkins and Mitchell 'Servis' washing machine. The bottom agitator, for Thor Appliances Ltd., was moulded by British Moulded Plastics Ltd.

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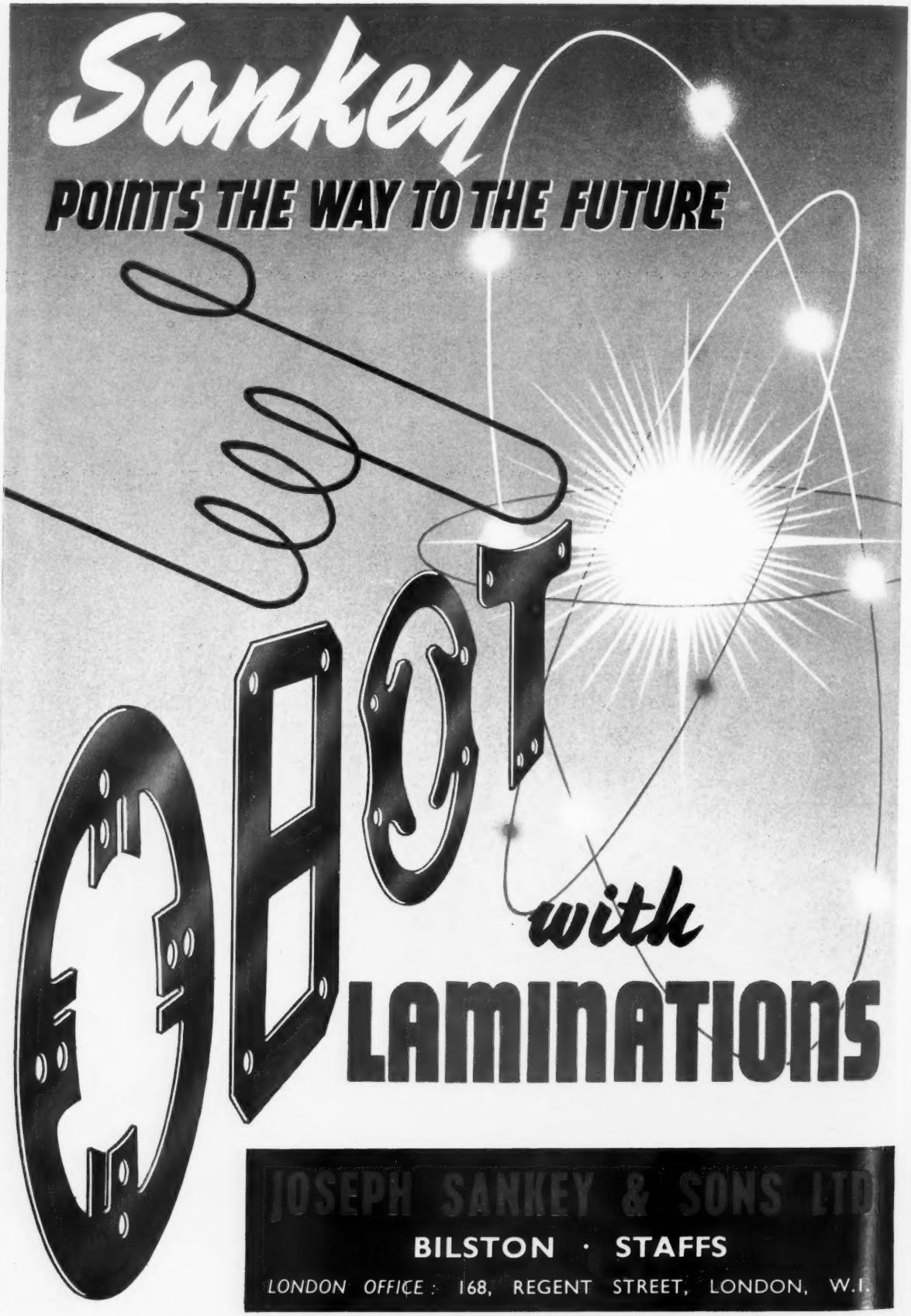
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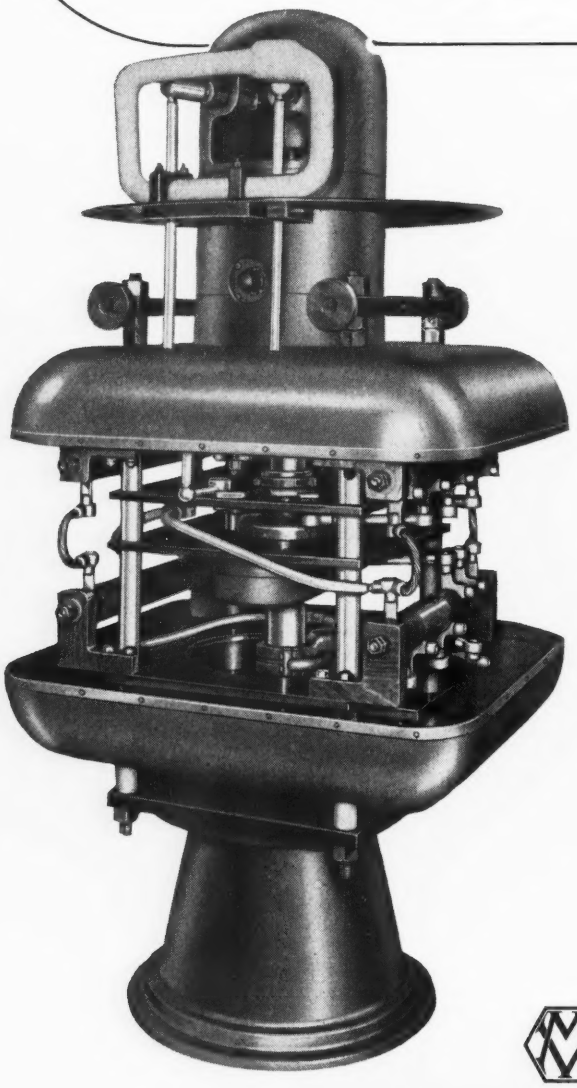

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Close-up view with cover removed of selector switch on Metrovick on-load tap changer developed for 220/150 kV three-phase transformer group built for the Netherlands.

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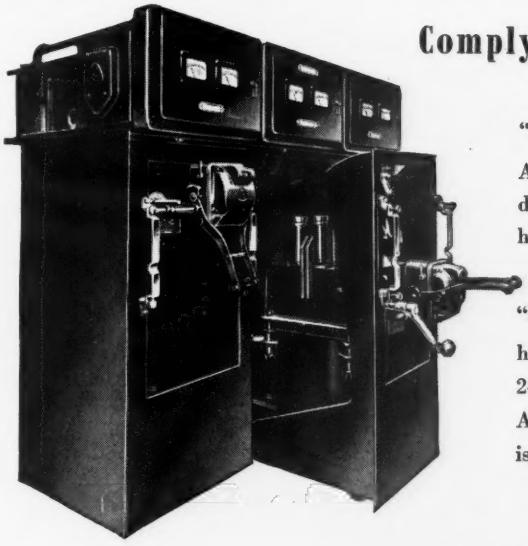

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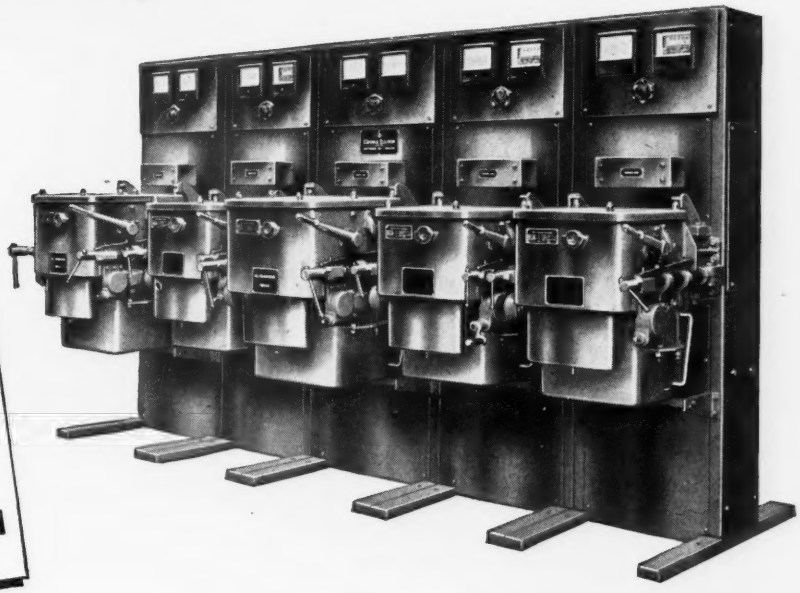

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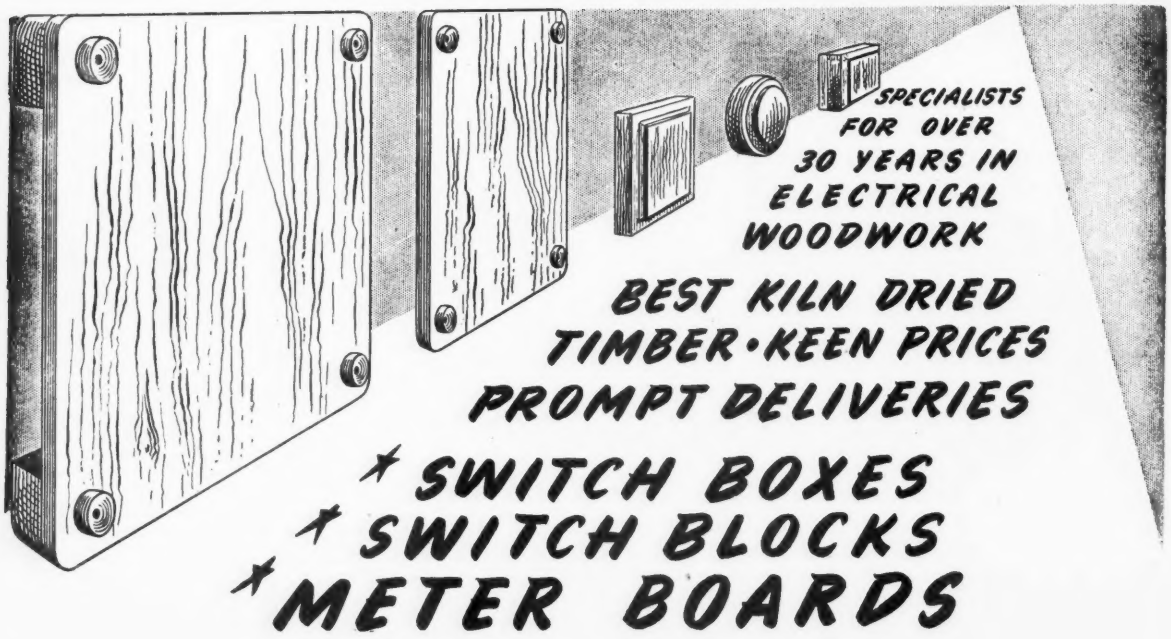

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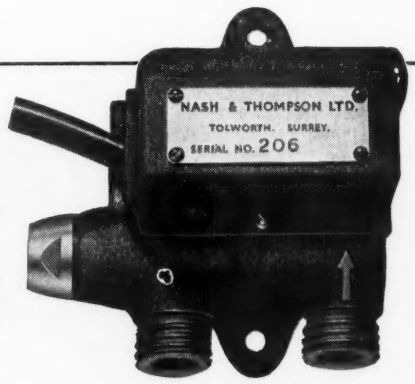

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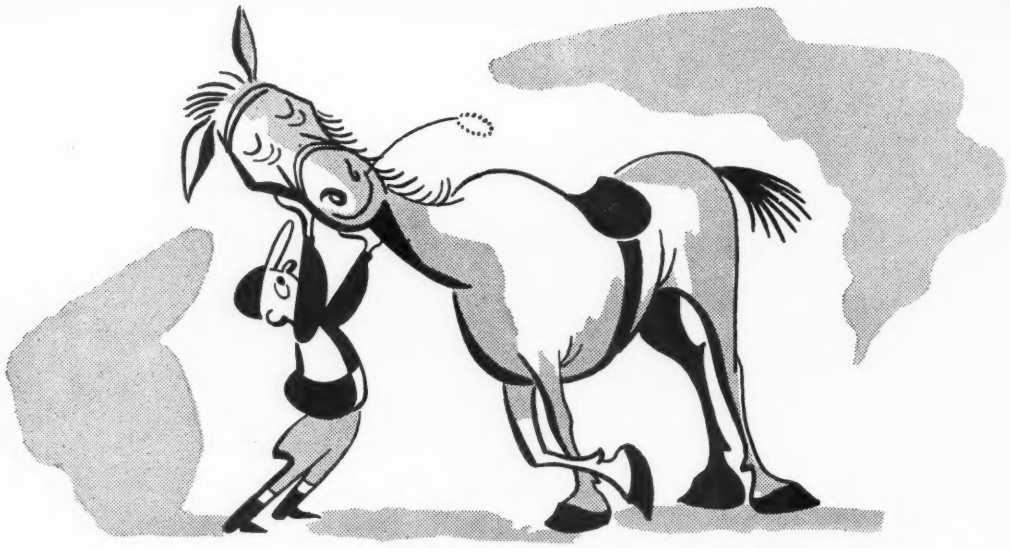

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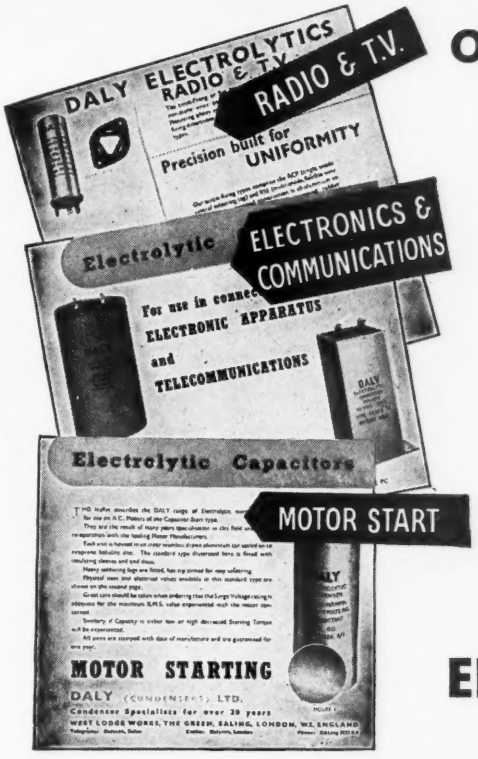

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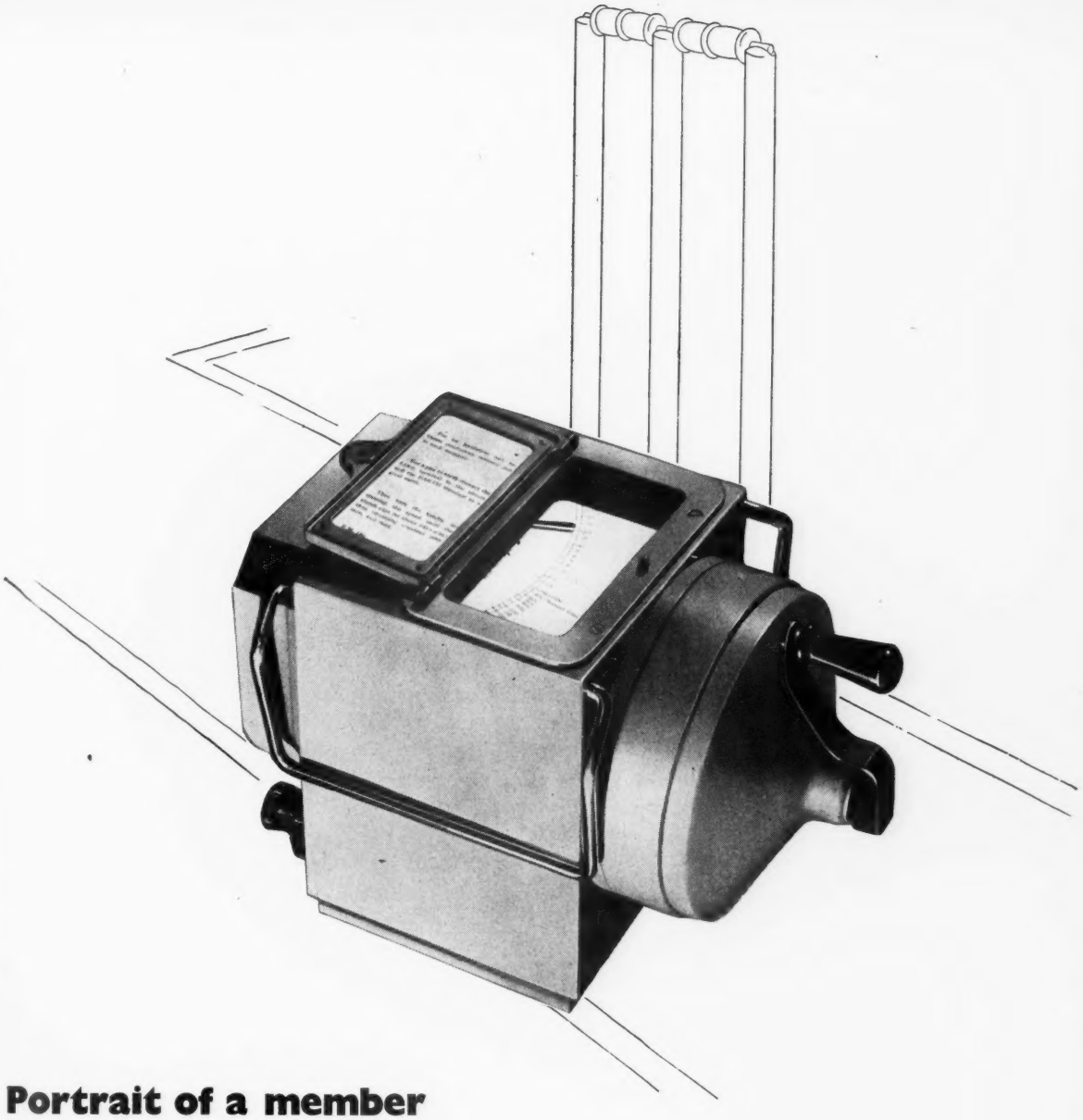

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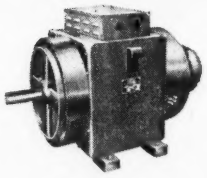

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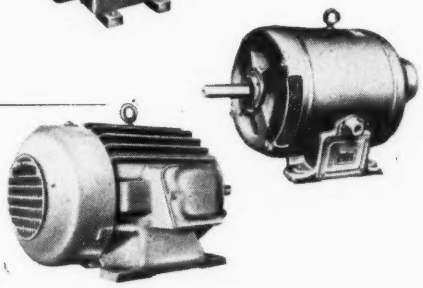

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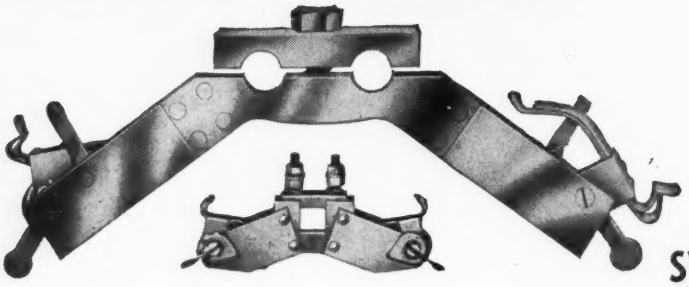

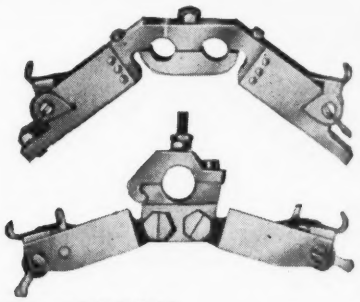

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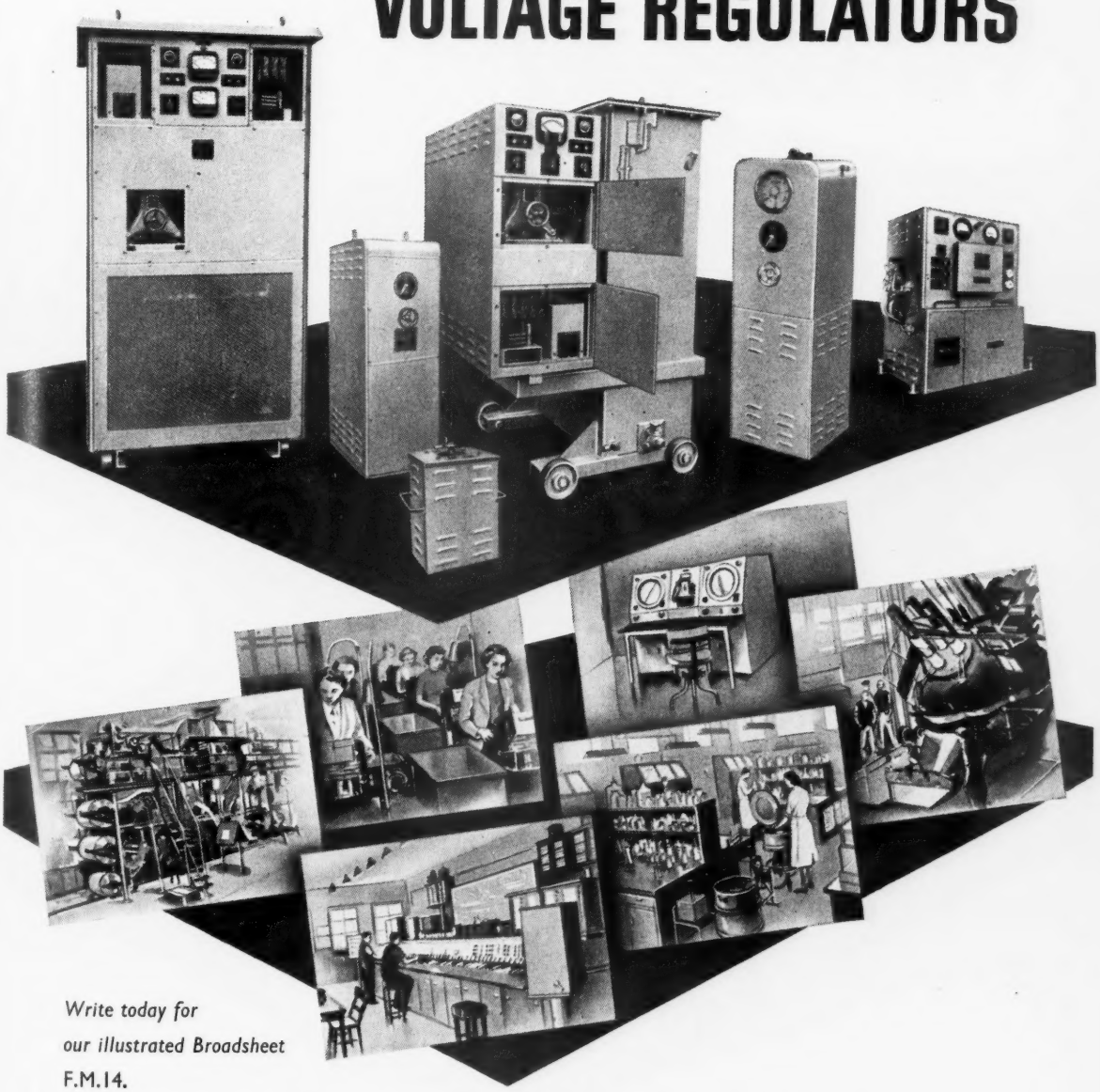

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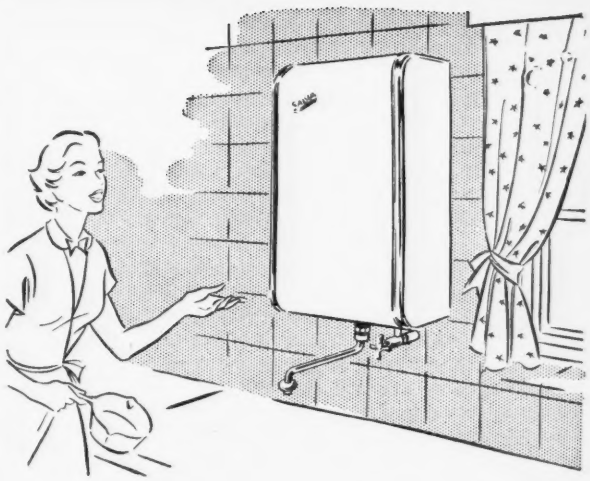

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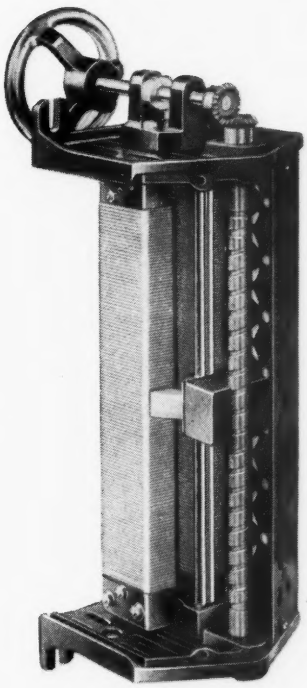

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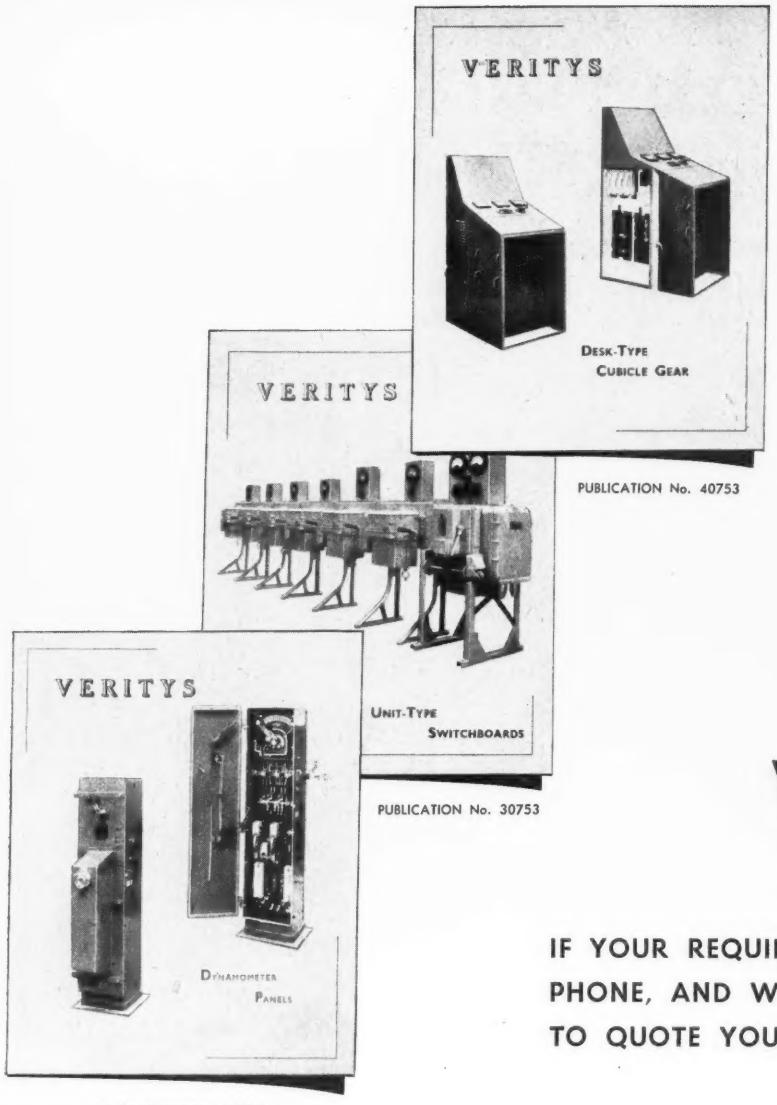

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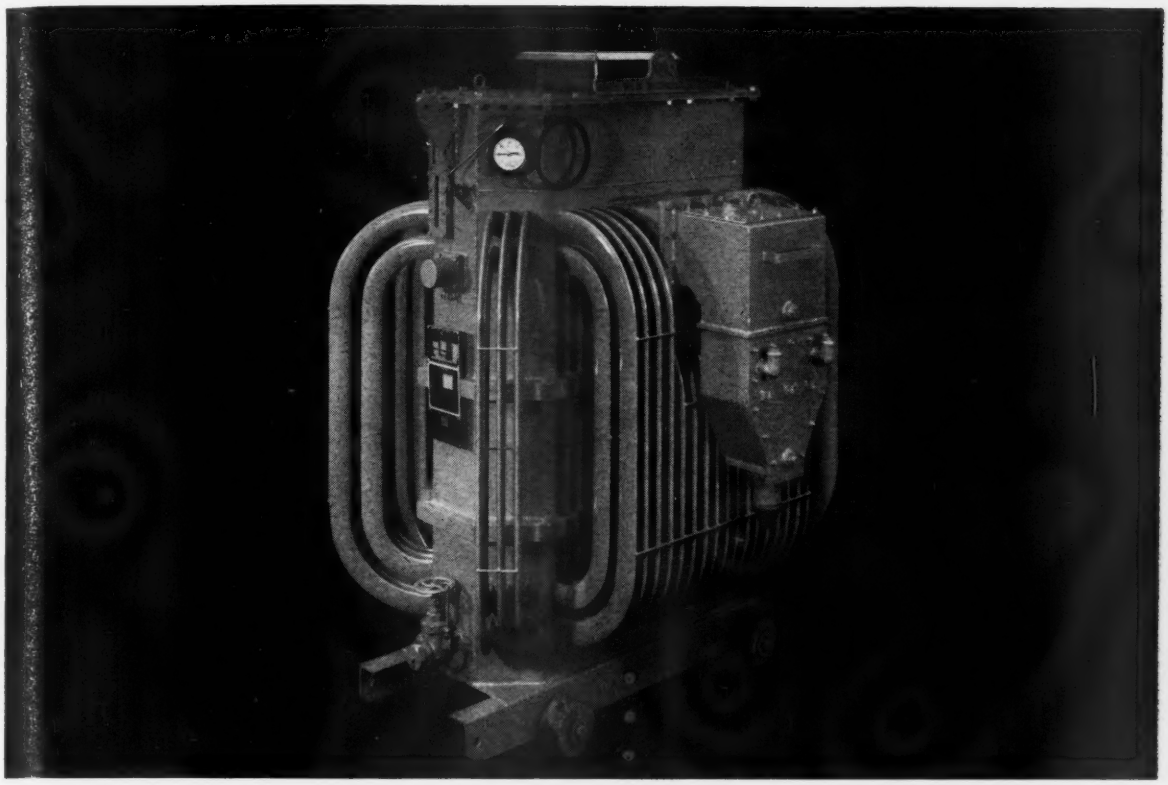

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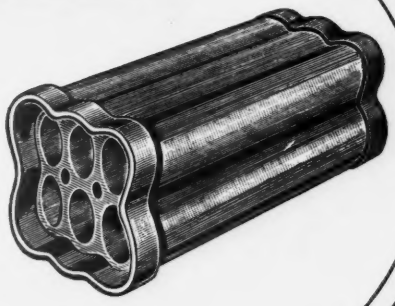

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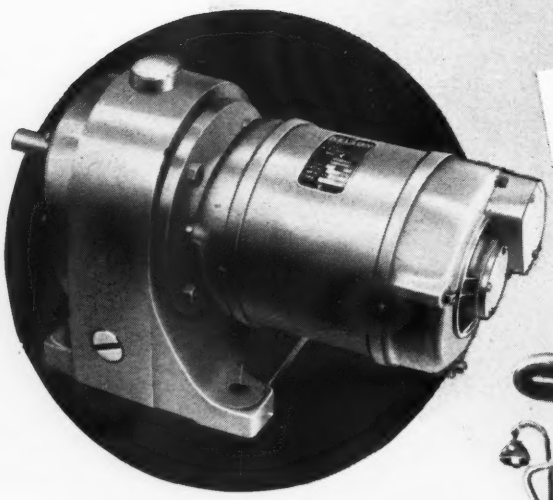

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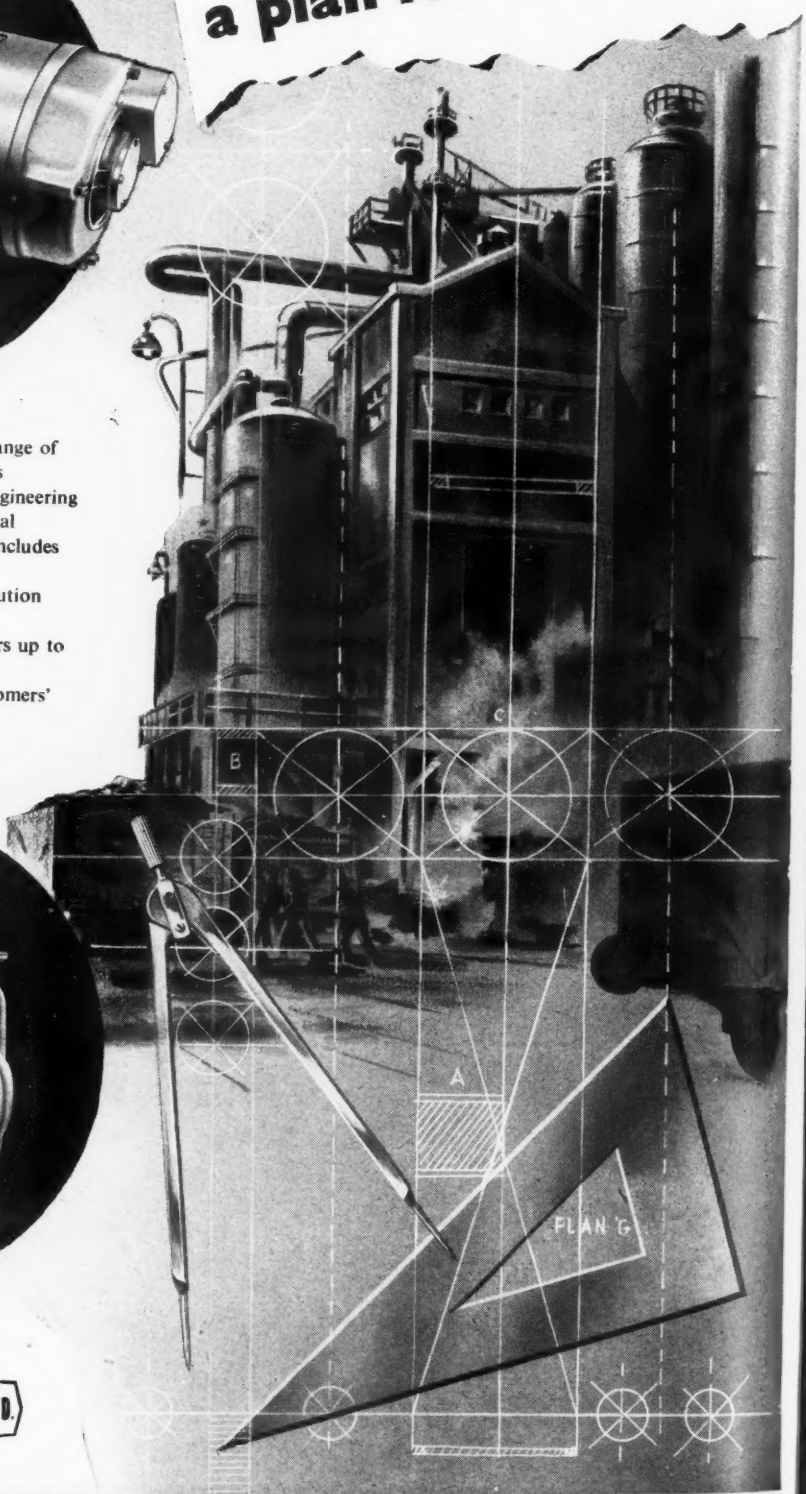

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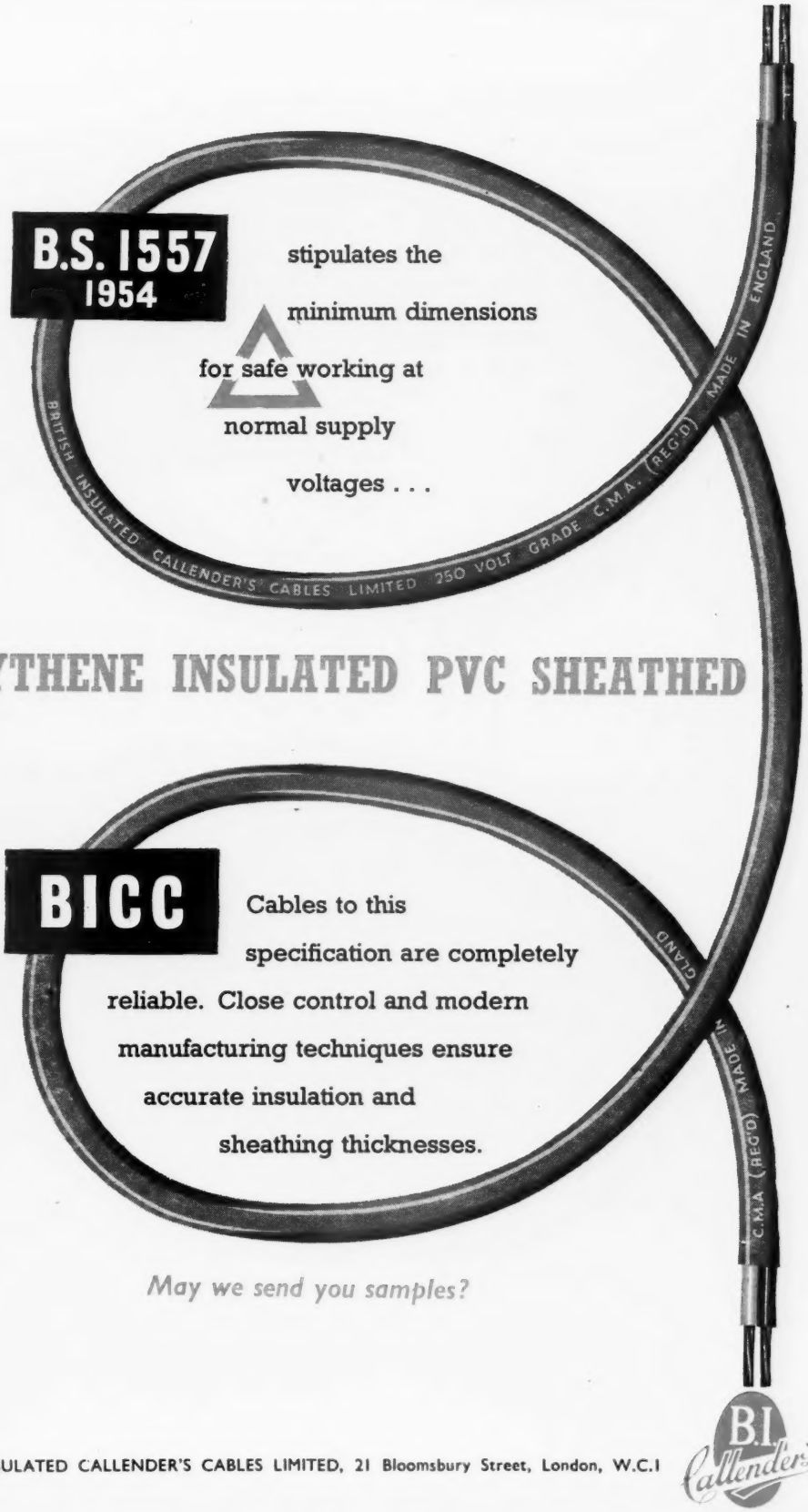

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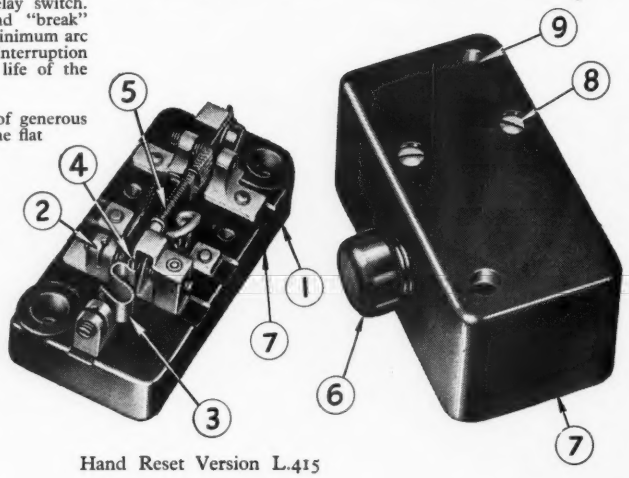

Hand Reset Version L.415
Automatic Reset Type L.413
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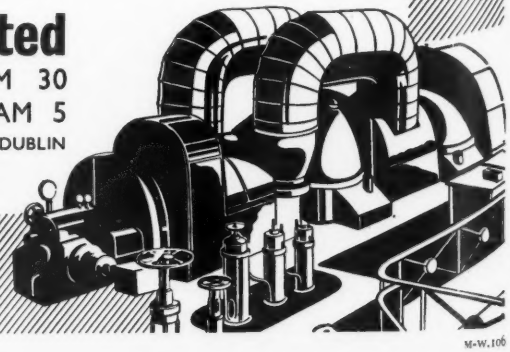

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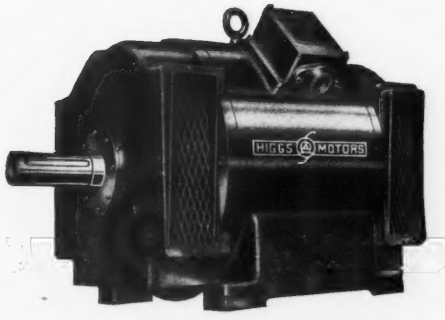

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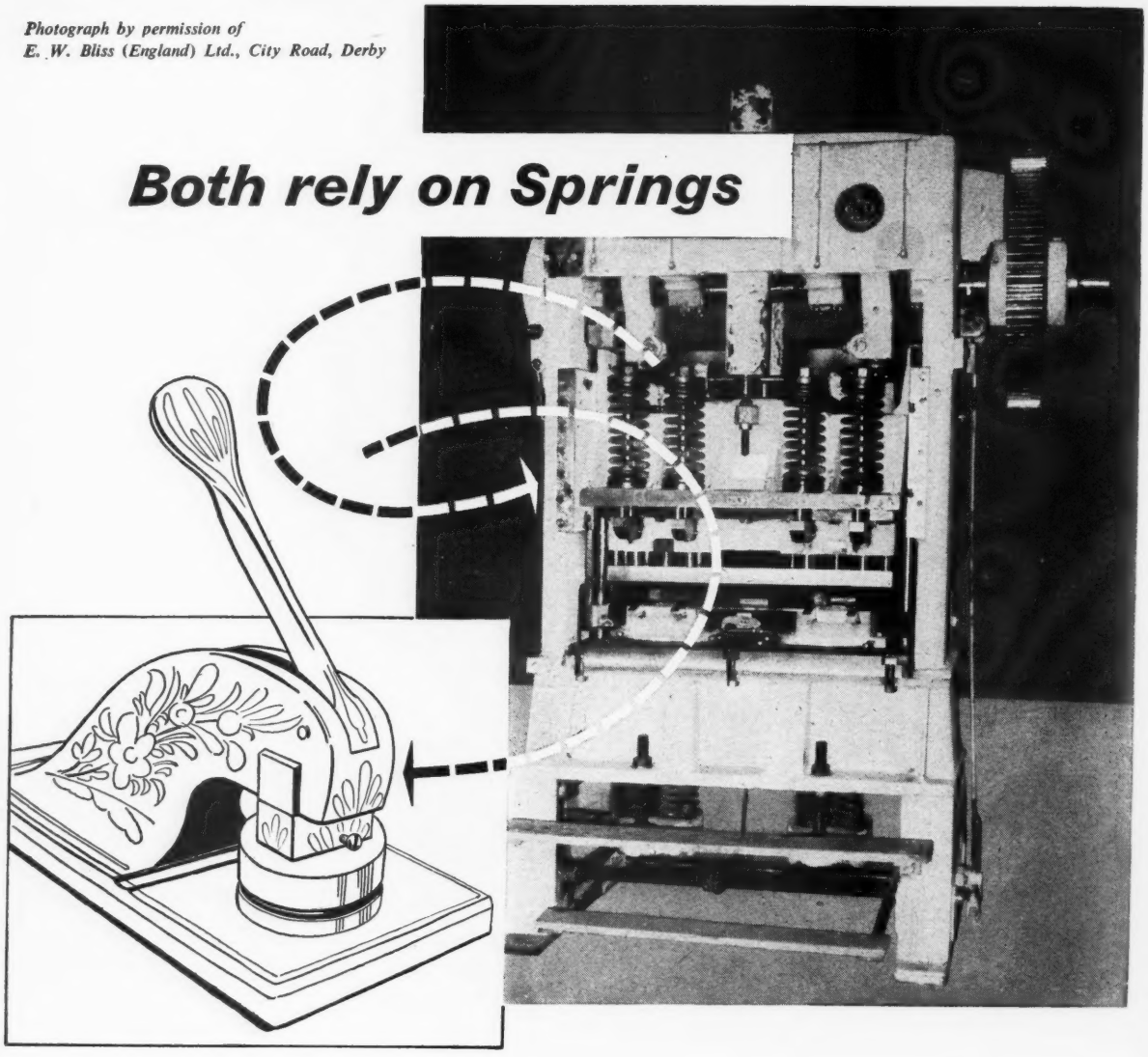

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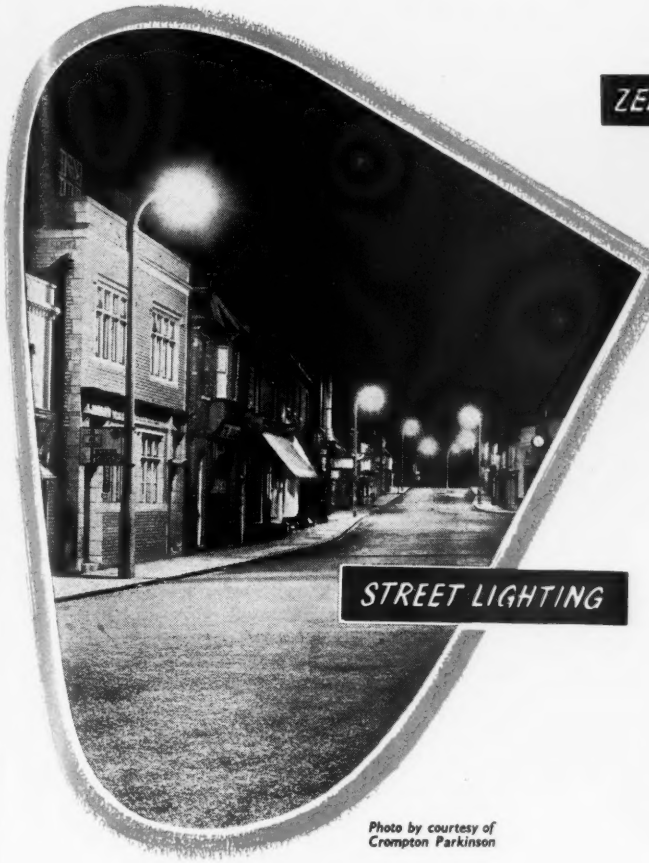

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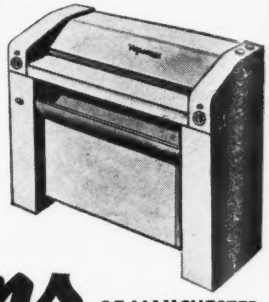

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A NEWS ITEM that pin-points the importance of INDICATOR-LAMPS

AS WARNING OR SIGNALLING DEVICES IN EQUIPMENT

These two giants of the air might well have run into serious trouble, had it not been for the warning given by the faithful Signal-Lamp. This news item draws attention to the fact that no-one can afford to be without visual warning or indicating devices with costly or vital apparatus. The Bulgin range of Signal-Lamps offers a reliable method of warning. A vast choice of different sizes and types with a variety of sockets for all usual lamp-caps. Plastic or Glass lenses are available in Red, Blue, Green, Orange, White and Water clear, transparent and translucent.

A FLASHING RED LIGHT SAVES AN AIR GIANT

SPLIT-SECOND decisions to save their planes were made by two test pilots at the Farnborough (Hants) Air Show after a red warning light suddenly began flashing in both their cockpits yesterday.

DECISION No. 1 was taken by Roland Falk Avro's chief test pilot. He was roaring down the runway in the Vulcan Delta bomber when the red light flashed. It told him something was wrong with his fuel pressure.

Throttled Back

He throttled back, stopped the giant bomber, and taxied back to the hangar. The fault was a minor one.

DECISION No. 2 was taken by Dave Morgan, flying the Supermarine Swift, fastest fighter in service with the RAF.

He had just given a display of high-speed aerobatics, when the little red light flashed in his cockpit. He made an emergency landing at an airfield near Farnborough. Again the fault was only a minor one.

Three of the five Gloster Javelin supersonic jet fighters were withdrawn from the air show because they are urgently needed by the RAF.

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While not professing to know all the answers to pressing problems, we have had a long and wide experience of all types of pressings in steel and light alloys, and it is more than likely we can help you with your particular problem, especially if it is a question of finding someone to do a good job, quickly. In the field of radar equipment and cabinets we have carried out many important contracts. We invite you to send us your enquiries which will receive prompt and careful attention.

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Length 9 in.

25 watts — 200/220 volts or 220/240 volts.

Interesting features

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(2) Steel cased element, also replaceable.

(3) Detachable hook for suspending iron when not in use.

(4) Moulded two part handle, remains cool in use.

(5) 6 ft. Henley 3-core Flexible.

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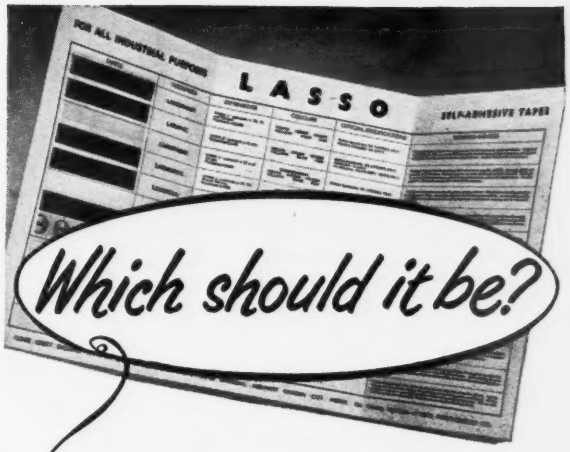

Which should it be?

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. . . probably Lassometic

. . . only 3/1000 thick, yet has excellent electrical properties, high tensile strength and is extremely pliable. These qualities make Lassometic an ideal insulation for use where lack of space renders other materials unsuitable.
It has, of course, many other uses, from wrapping H.T. battery cells to colour identification of wires and conduits. This may be just the tape you're looking for. It's easy to make sure, write for the Lassometic specification booklet.

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GL9

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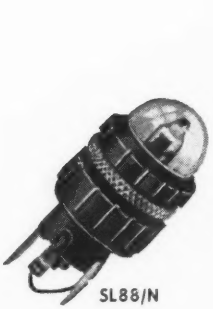
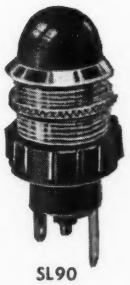
For Low Voltage or Mains

Illustrated are a few signal lamps taken from our wide range. The insulation of every Arcolectric signal lamp will resist a flash test of 1,500 volts A.C.

The SL90 illustrated here is a typical Arcolectric low voltage signal lampholder. It is designed to accept popular M.E.S. bulbs. The bulb is accessible from front or rear of panel. The domed plastic lens surrounded by a polished chromed bezel gives a most attractive panel appearance. This holder can be fixed in a single $\frac{3}{4}$" hole.

The mains voltage signal lamp SL88/N is supplied complete with an M.E.S. neon tube and a suitable series resistance.


SL88/N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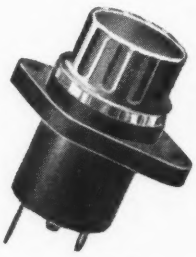
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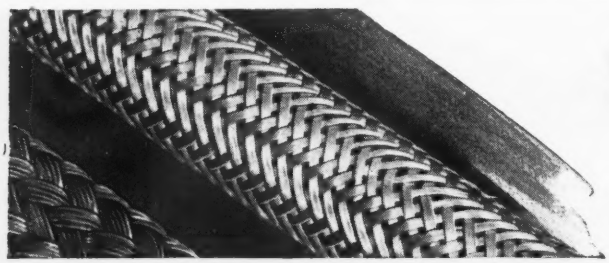

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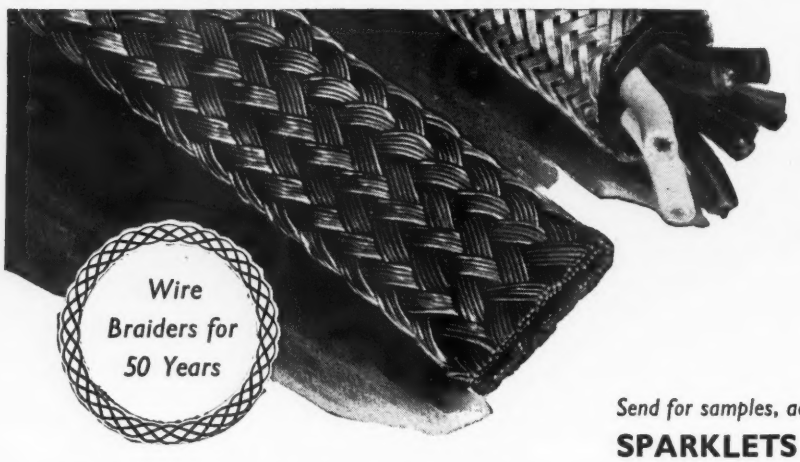

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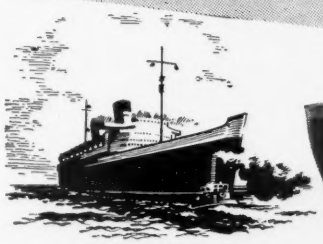

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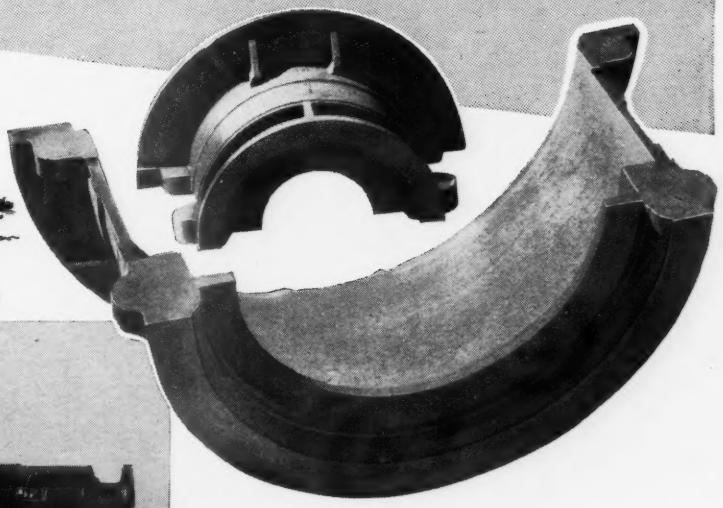

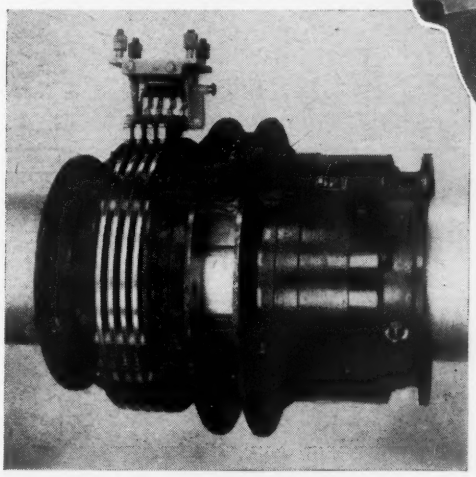

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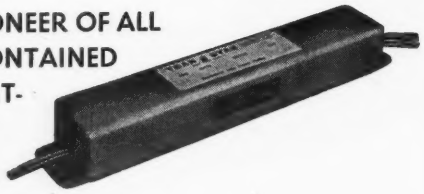

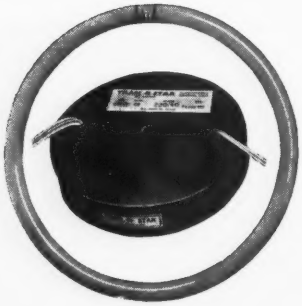

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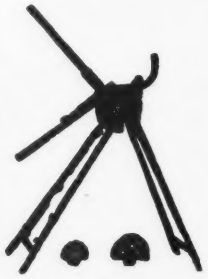

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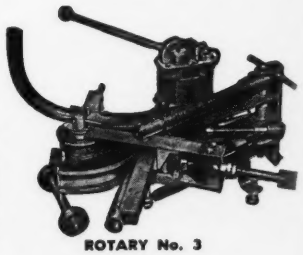

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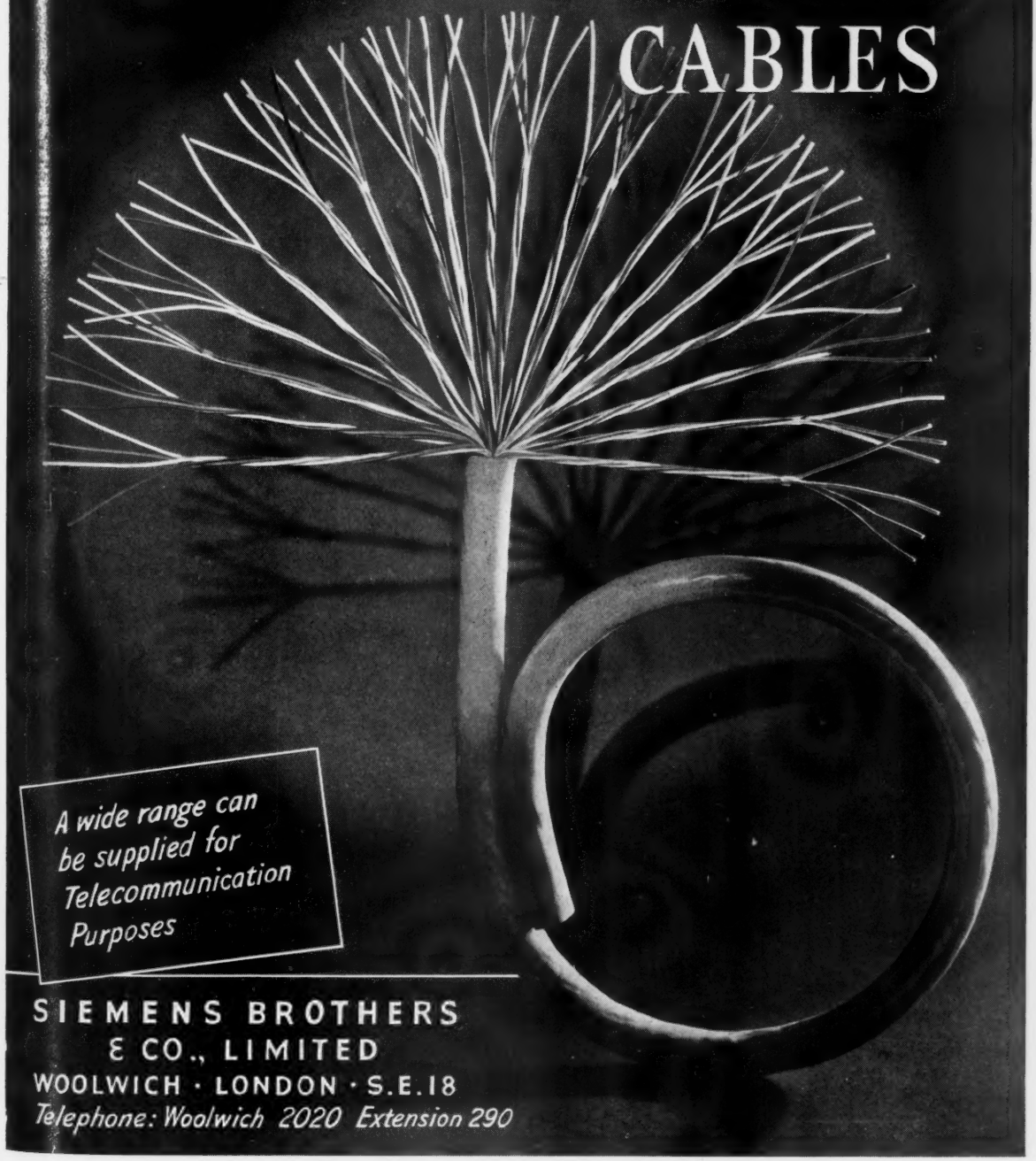

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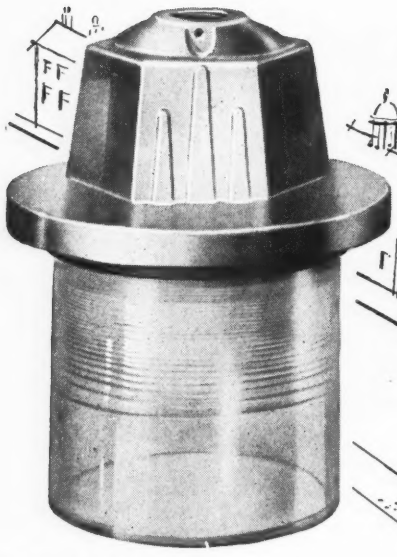
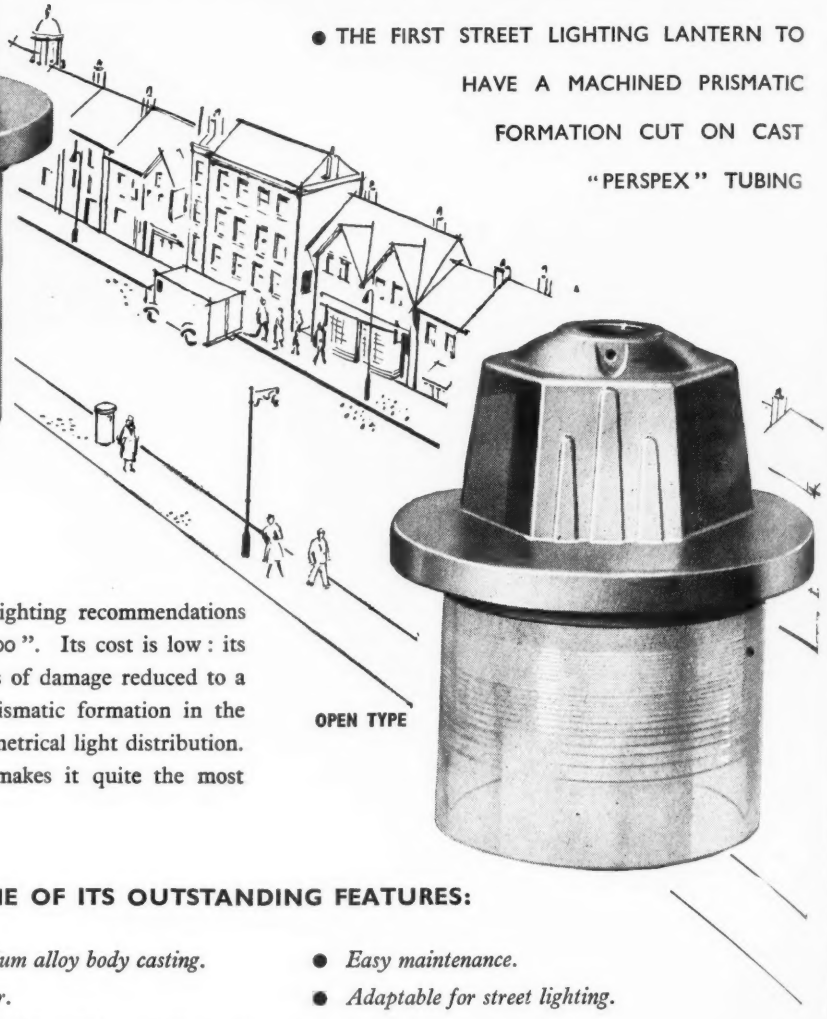


ENCLOSED TYPE



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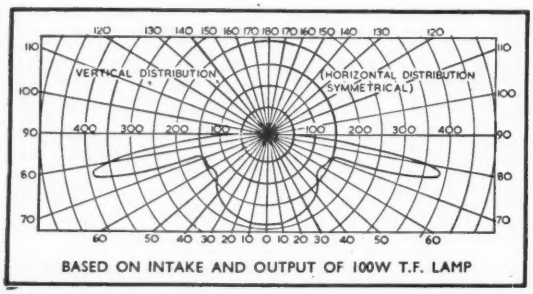

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Fire Research in 1952

DURING 1952 (the last year for which complete statistics are available) a total of 91,768 fires were attended by the N.F.S. or Fire Brigade, some 19,300 more than in 1951. Of the total, approximately half (46,696) were in buildings—a little over 4,000 more than the previous year. Electricity was associated with 8,016 of the latter. These figures are taken from the Report of the Director of Fire Research for last year, which also states that the total number of fires attended during 1953 amounted to approximately 87,000.

As can be seen from the table below, fires caused by electric wire and cable continued to form the largest proportion of fires with which electricity was associated. Electric fires, heaters and radiators, and refrigerators also contribute a high proportion. How many of these are due primarily to the user's carelessness, and not to a defect in the equipment, is impossible to estimate.

The study of the occurrence of fires in dwellings since 1946, with its detailed comparison of the behaviour of non-traditional post-war houses with that of pre-war houses continued in 1952. Non-traditional is applied to houses, ... permanent or temporary, built of materials or by ... ally used in this country before 1939. ... both in pre-war and in post-... comments that the Fire Research Board, the ... year had been heavily pruned, energy having thus to be concentrated on some of the more pressing items. Even so, the effort will still be meagre in some directions, and in all sections of the laboratory the pressure to obtain information for particular purposes can only be at the expense of the basic research for which there is a real need.

Causes of Fire in Buildings

Supposed cause of fire	1948	1949	1950	1951	1952
Electric cooker ...	444	744	740	784	804
Fire, heater, etc. ...	893	900	1,092	1,180	1,148
Iron	356	436	372	364	372
Motor	280	180	264	310	324
Refrigerator... ...	789	1,108	1,132	1,020	1,124
Wire and cable ...	2,353	2,680	2,250	2,694	2,728
Wireless, television	365	444	450	548	584
Other apparatus ...	540	736	906	948	924
Static electricity ...	19	24	22	32	8
Total associated with electricity	6,039	7,252	7,228	7,880	8,016
Miscellaneous and unknown	4,755	5,600	5,798	5,830	6,824
Total fires in buildings	37,246	42,792	43,744	42,394	46,696

Extract from 'Electrical Times' dated July 1st, 1954

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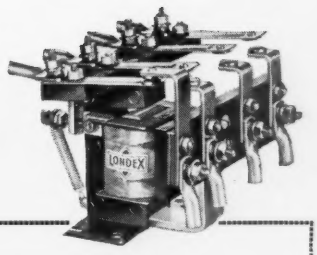

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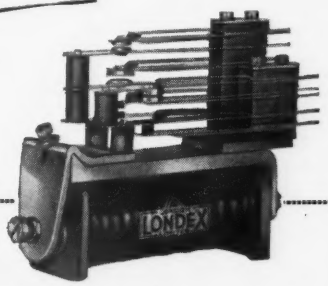

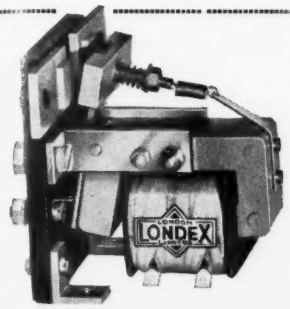

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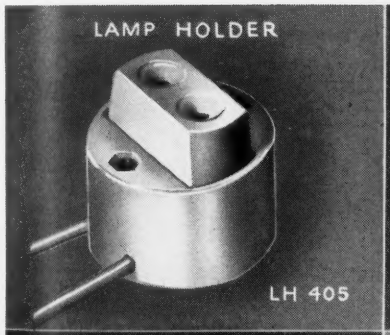

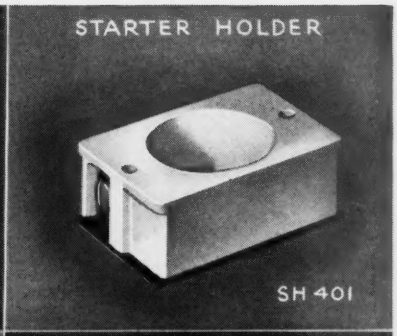

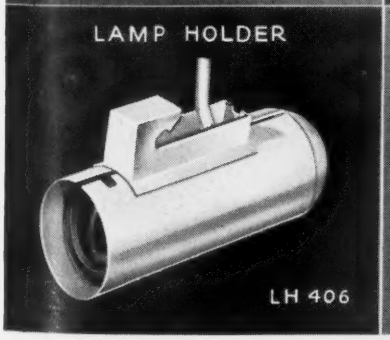

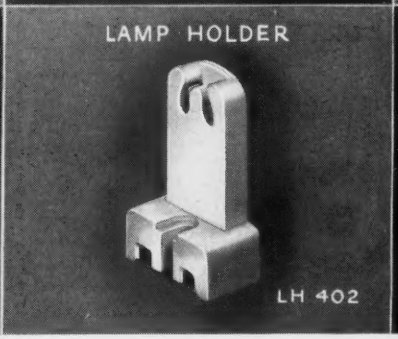

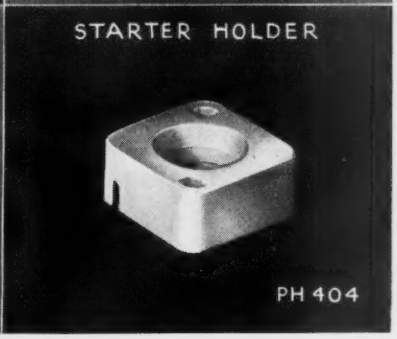

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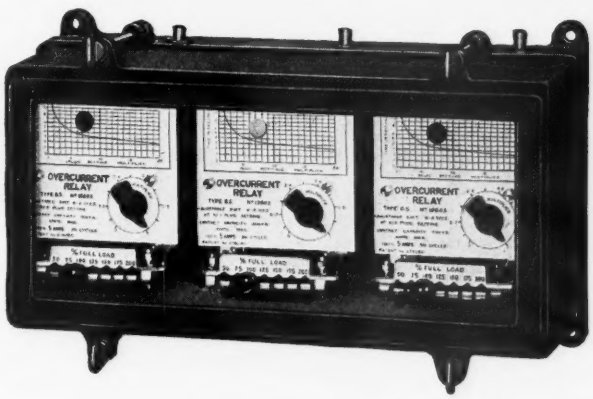

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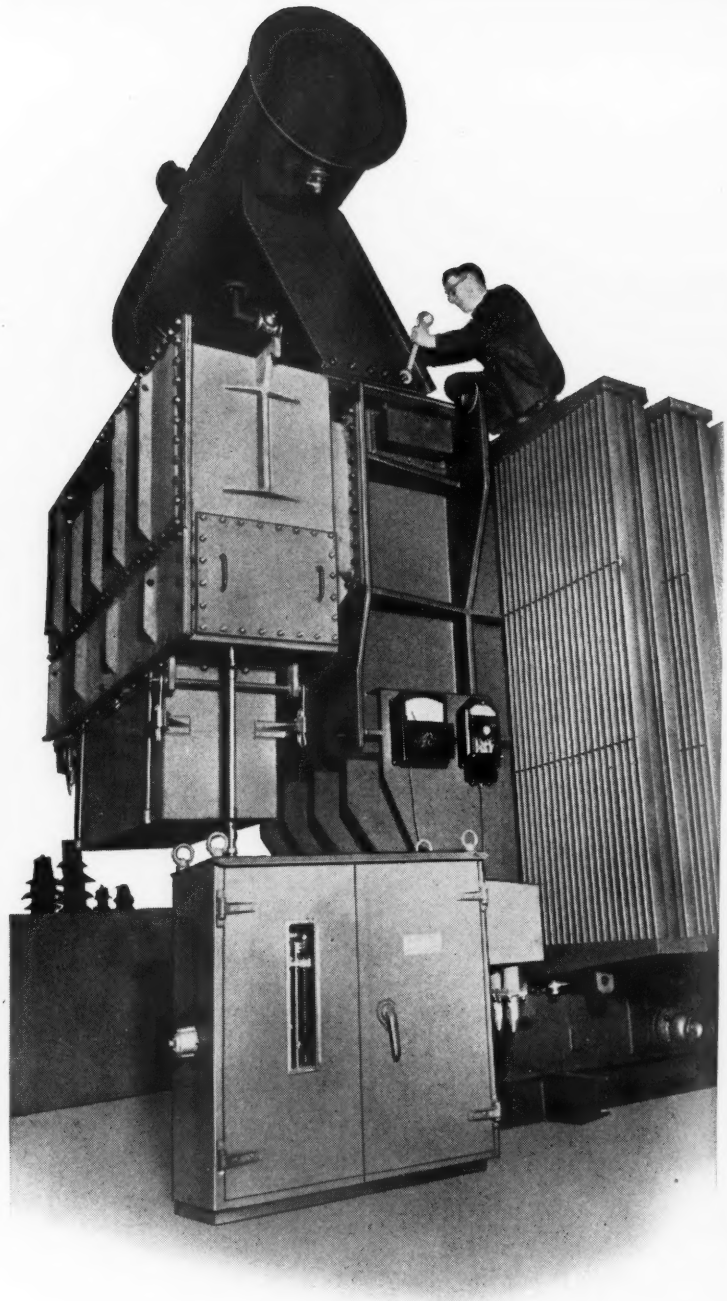

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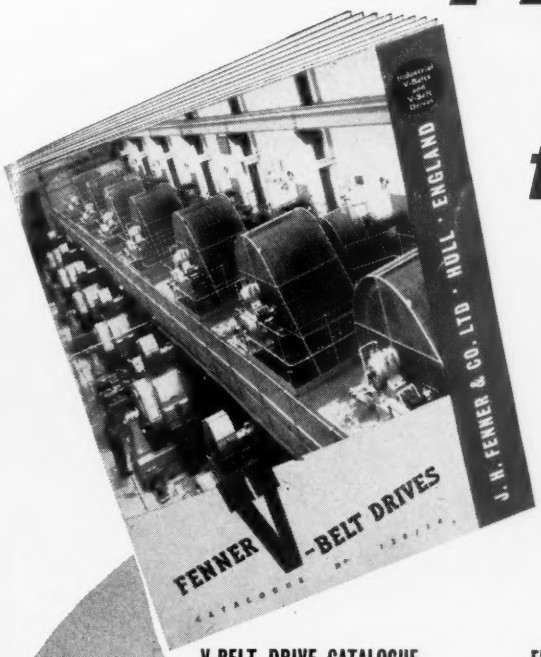

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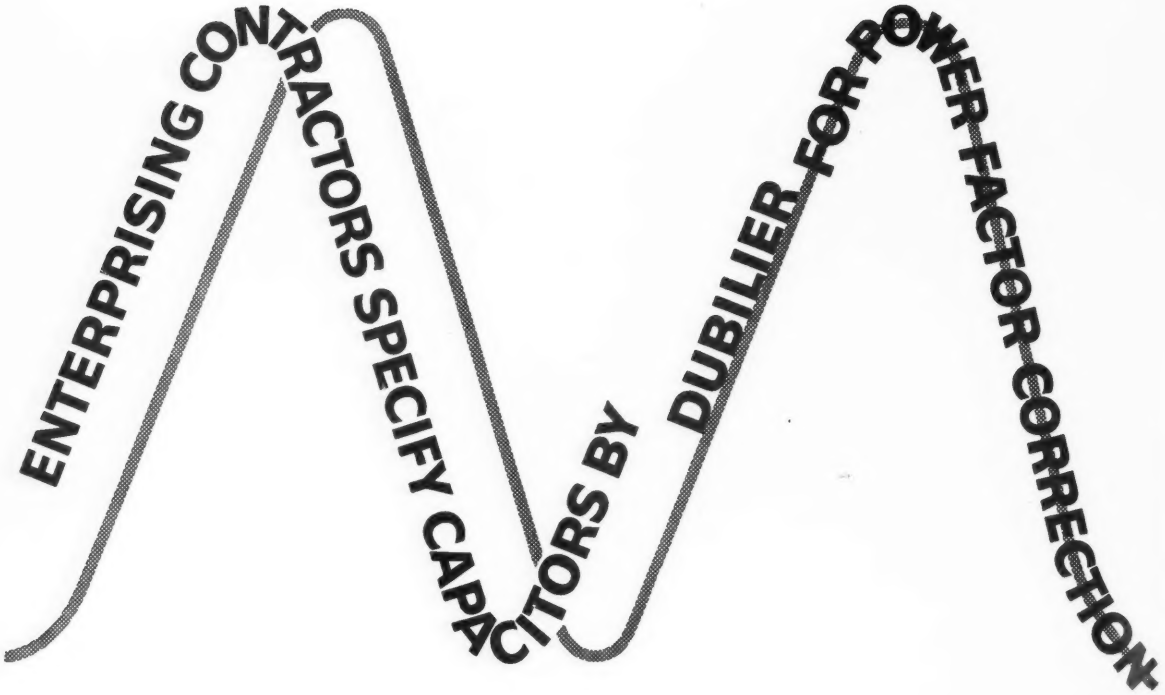

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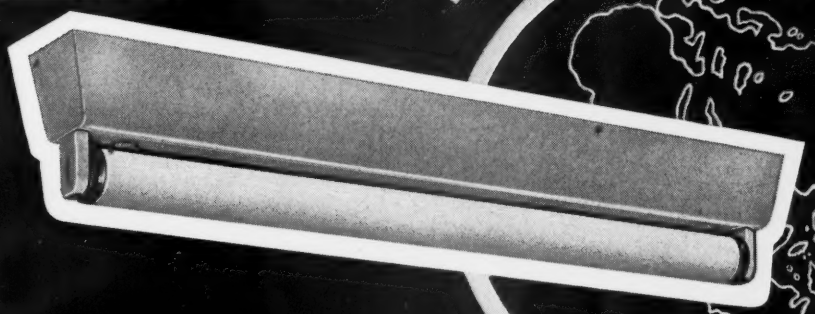

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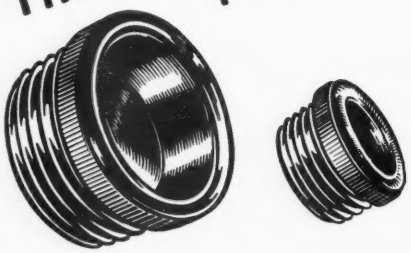

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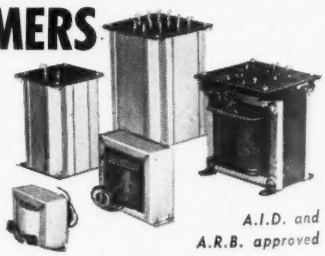

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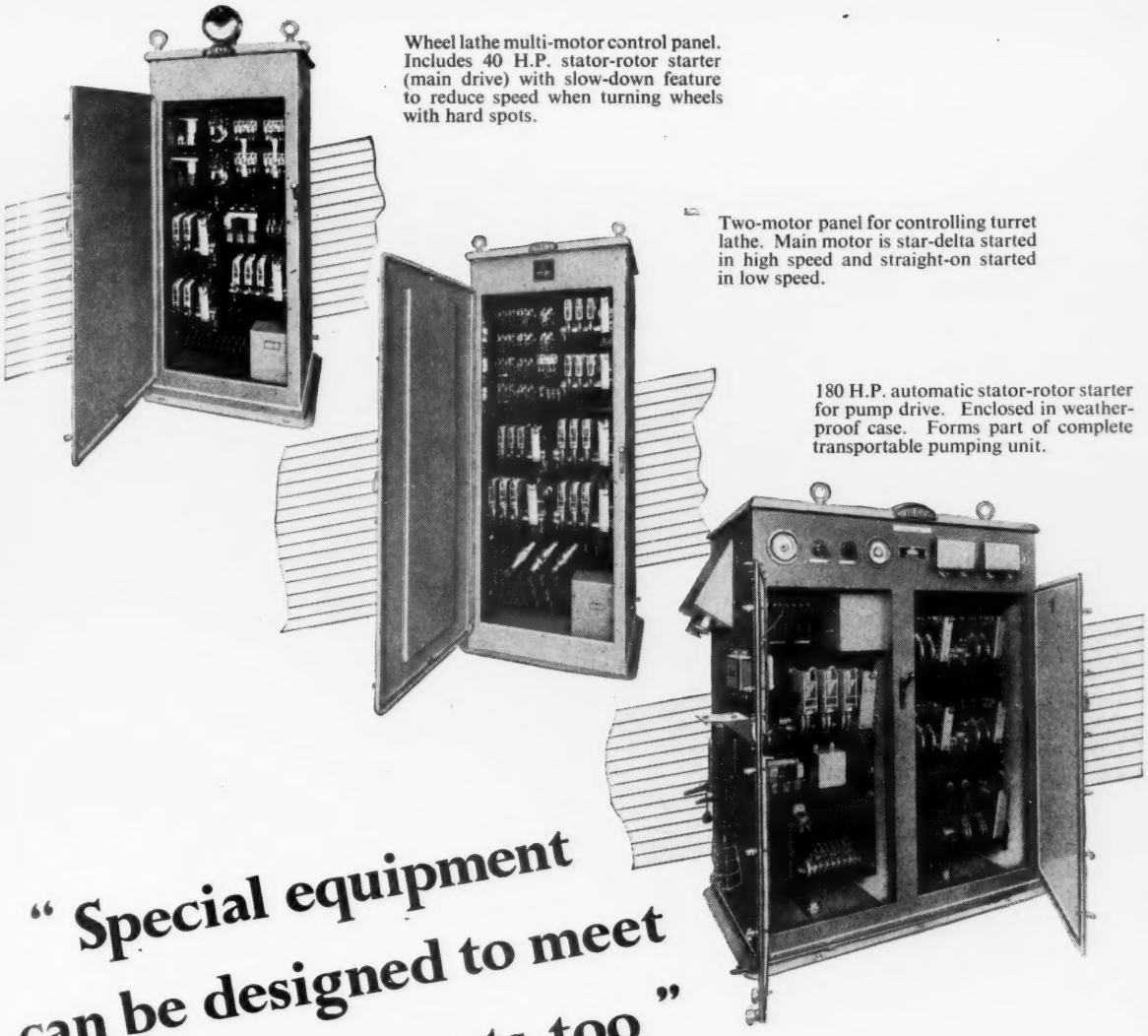

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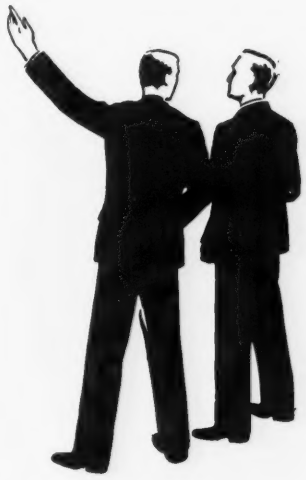

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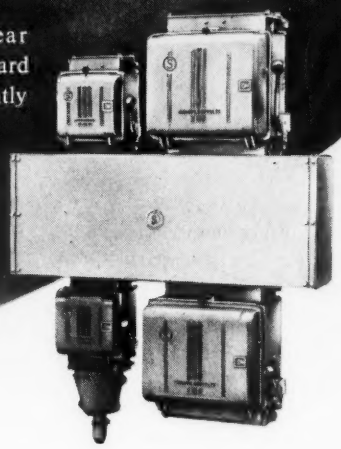

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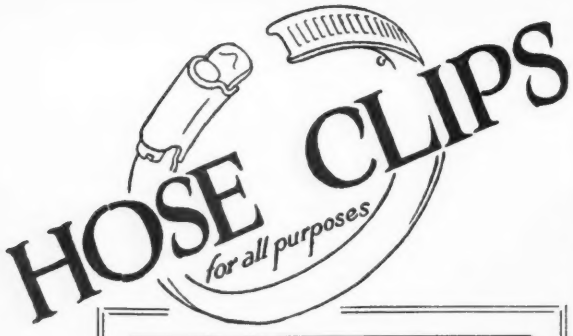

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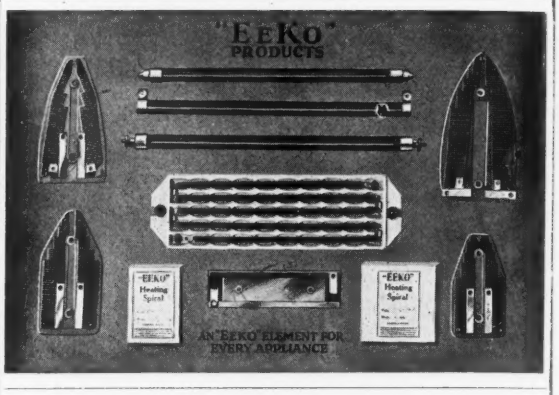

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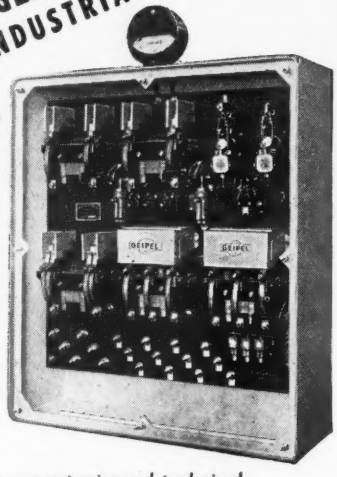

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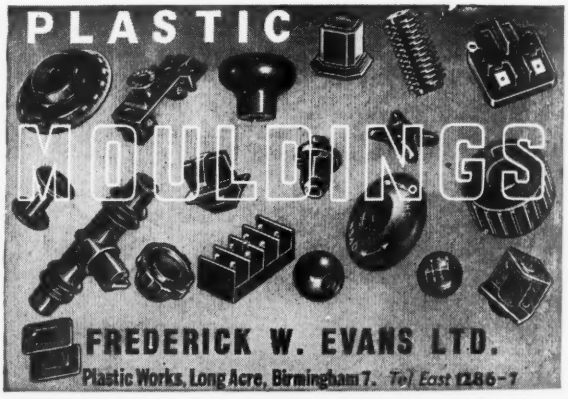

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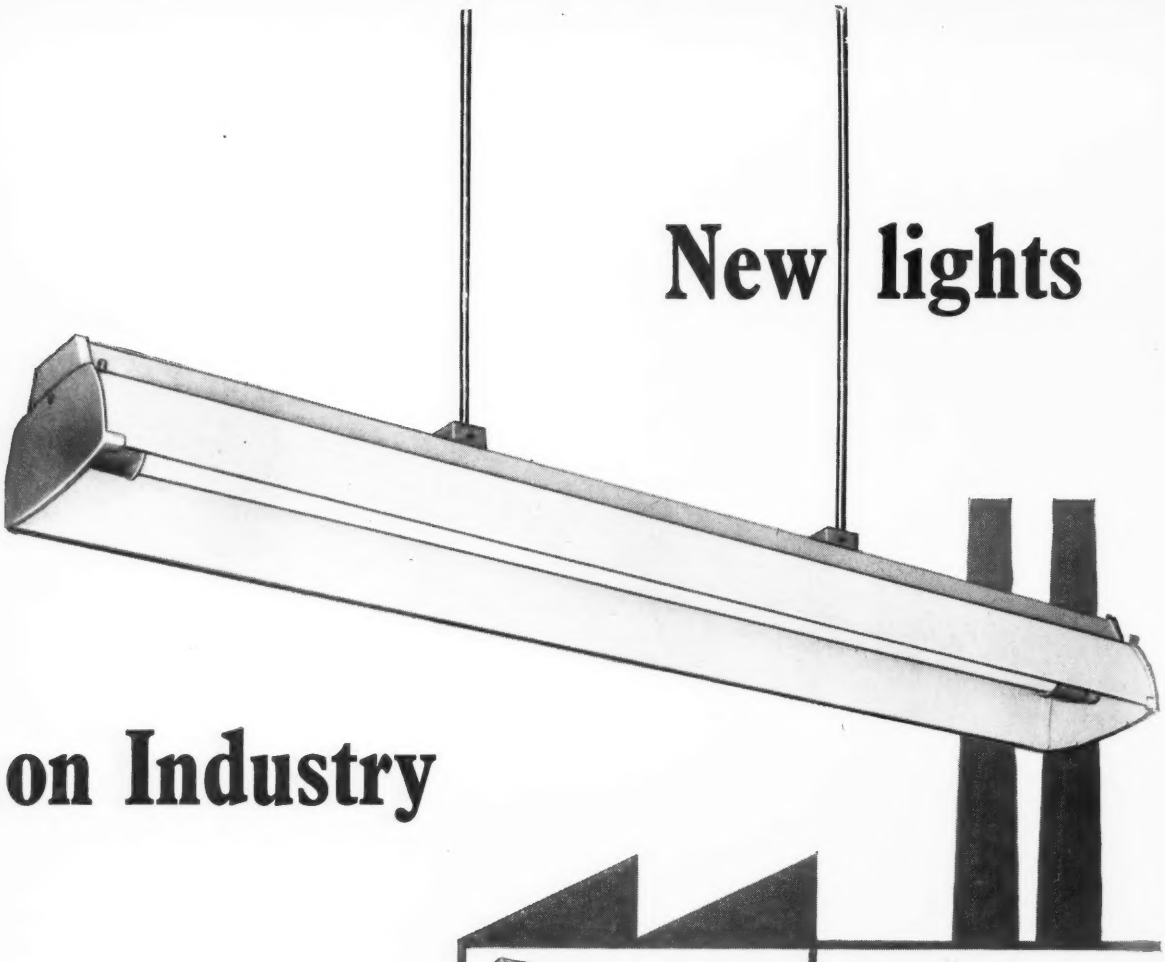

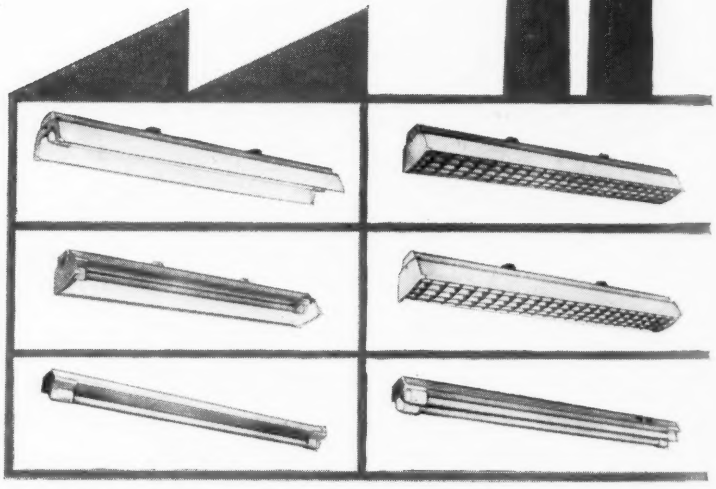

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TYPE

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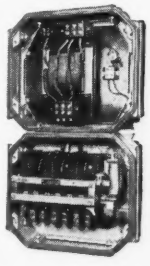
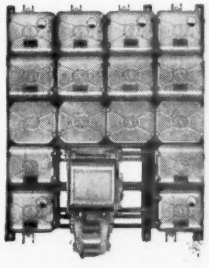


A triple pole 30 amp. Circuit Breaker with core balance transformer and E.L. relay



A typical multi-way 15 amp. board with instruments. Individual panel isolators also available.

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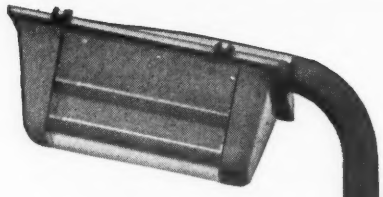

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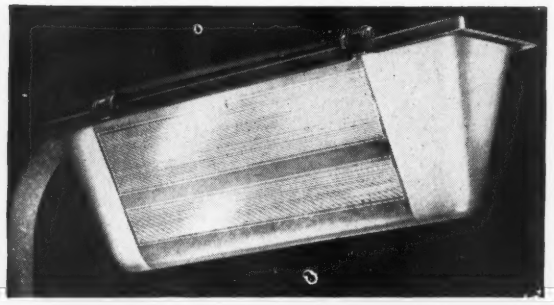
STREET LIGHTING LANTERN

FOR CRAWLEY NEW TOWN

The new street lighting lantern manufactured and supplied by The Edison Swan Electric Co. Ltd. and installed in the new town at Crawley has a clear 'Perspex' bowl with opalised ends. The light distribution is controlled by two machine-cut 'Perspex' refractor plates sealed to the inside of the bowl on either side of the lantern.



'Perspex' is the registered trade-mark for the acrylic sheet manufactured by I.C.I.

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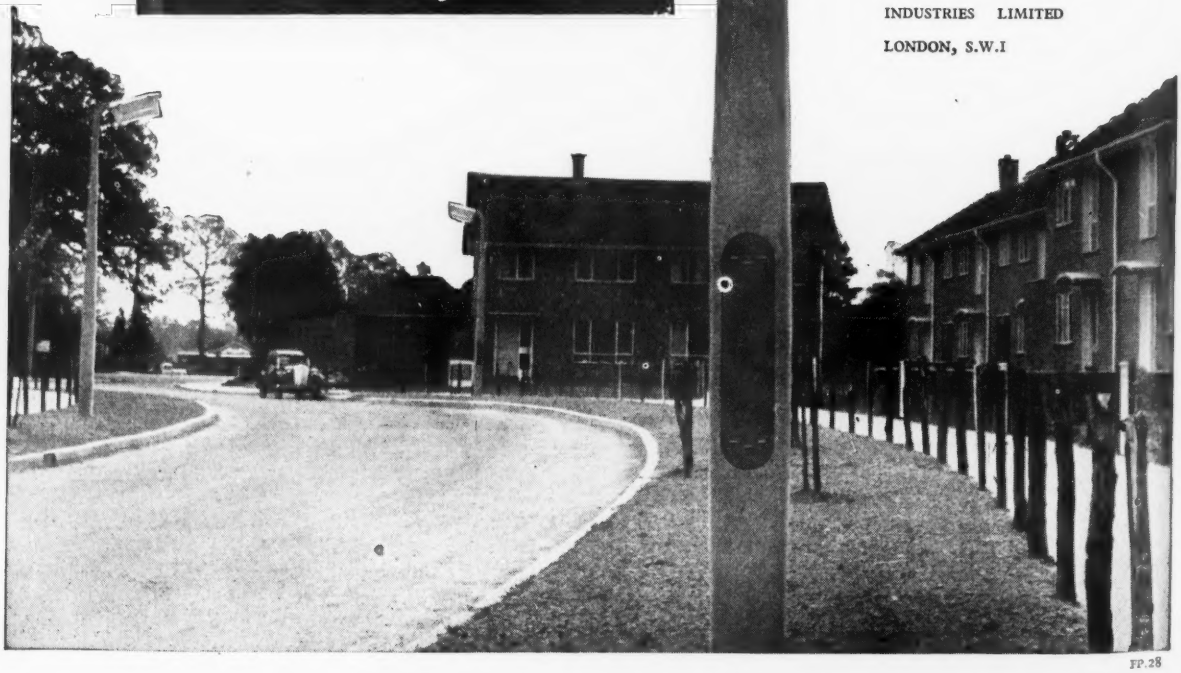
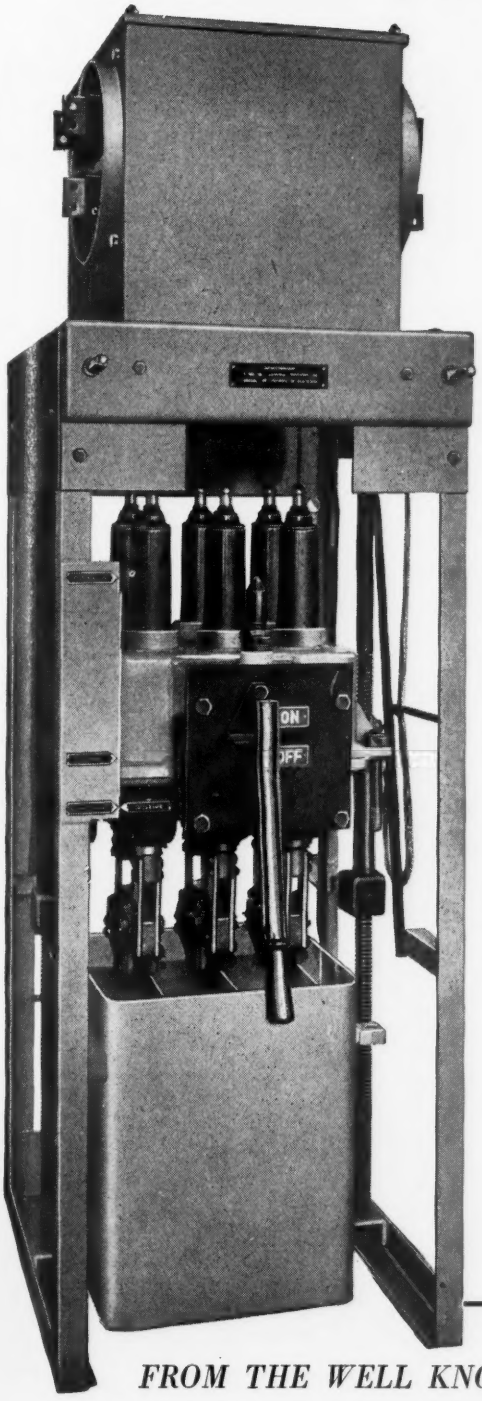


FP.28

AN OIL-SWITCH YOU CAN

ISOLATE

without interrupting supply in ring main units



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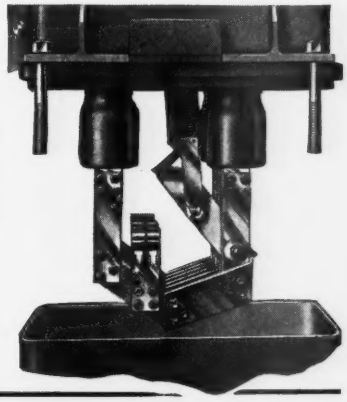
. . . to enable complete isolation of the switch for ease of inspection and maintenance (with no interruption of supply in ring main units)

. . . to make and carry fault currents up to 250 MVA at 6.6 kV (also tested to B.S. 116/1937)

. . . so that electro-magnetic forces assist the closure of the switch under through-fault or short-circuit conditions (it cannot possibly be forced open)

. . . for mounting on a simple framework (yet having a full complement of interlocks)

. . . for maximum voltage of 11 kV and maximum current rating of 600 amperes (it has liberal clearances yet small dimensions)



★ Internal view of a unit showing contact arrangement

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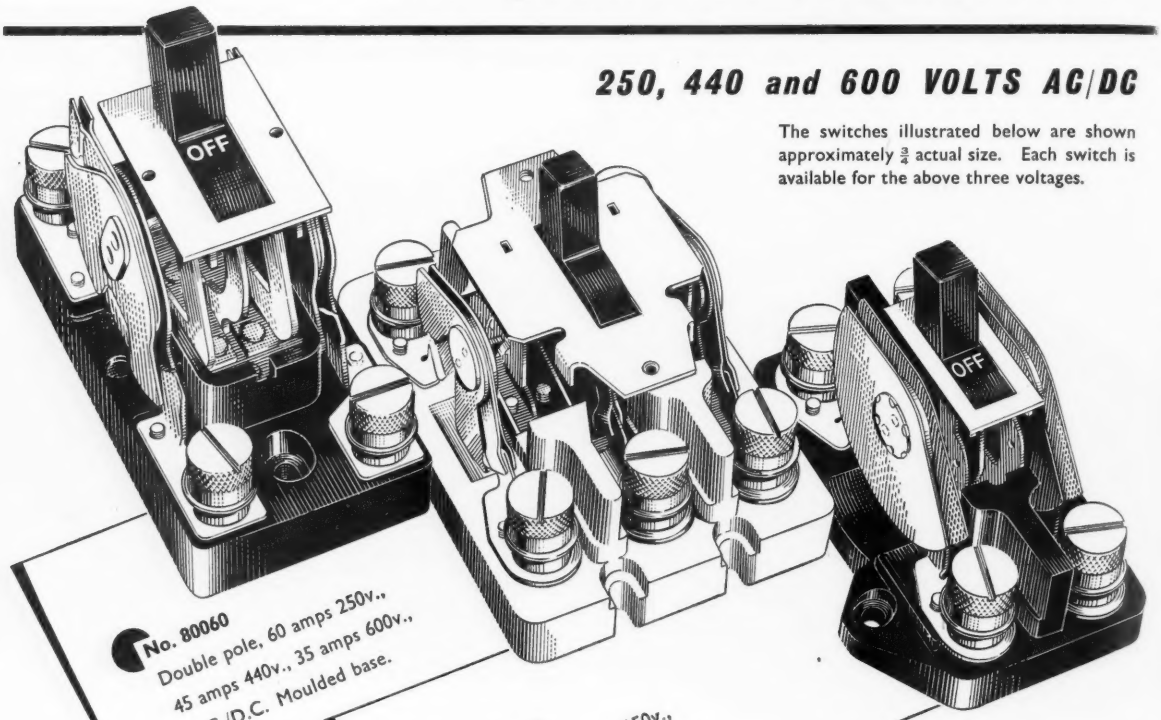
HEAVY DUTY TUMBLER SWITCHES

for panel manufacturers . . .

250, 440 and 600 VOLTS AC/DC

The switches illustrated below are shown approximately ¾ actual size. Each switch is available for the above three voltages.



No. 80060
Double pole, 60 amps 250v.,
45 amps 440v., 35 amps 600v.,
A.C./D.C. Moulded base.

No. 80104 P
Triple pole, 30 amps 250v.,
25 amps 440v., 20 amps 600v.,
A.C./D.C. Porcelain base.

No. 80094
Double pole, 30 amps 250v.,
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- **For panel or baseboard mounting**
- **Very compact for ratings**
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No. 51	B.C. to B.C.	Brown
No. 52	E.S. to 2-pin	Brown
No. 53	E.S. to M.E.S.	Brown
No. 54	B.C. to E.S.	Black
No. 55	E.S. to B.C.	Brown
No. 56	2-pin to B.C.	Brown
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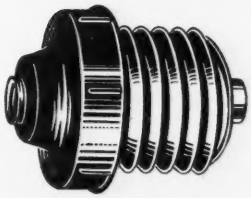
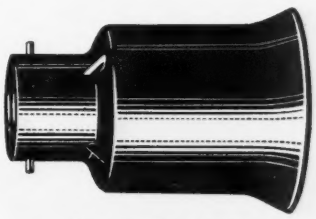
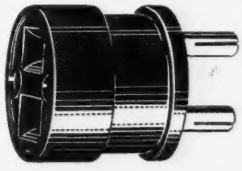


E.S. to M.E.S. TYPE



B.C. to E.S. TYPE



2-PIN to FLAT-PIN TYPE

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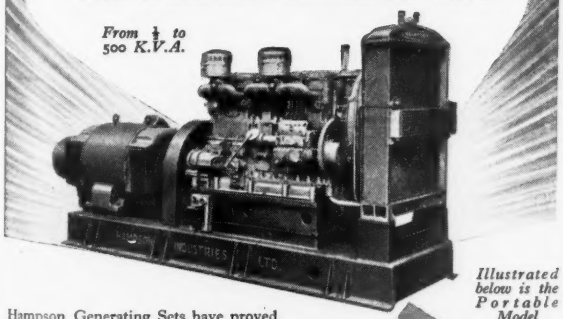
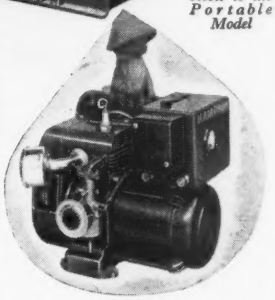
From ¼ to 500 K.V.A.



Illustrated below is the Portable Model



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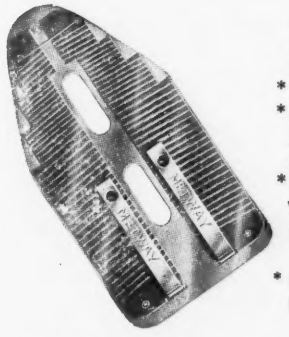

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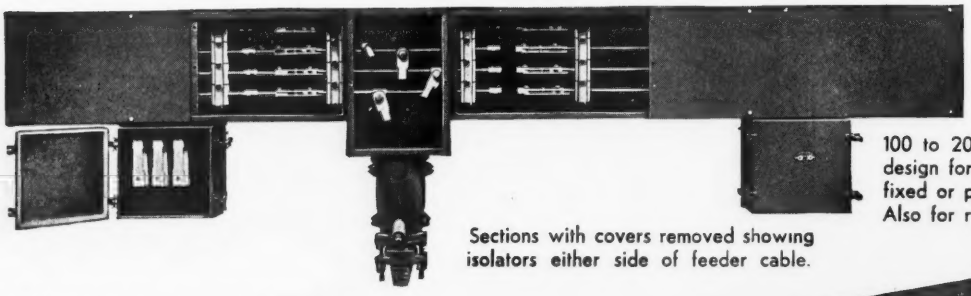

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Sections with covers removed showing isolators either side of feeder cable.

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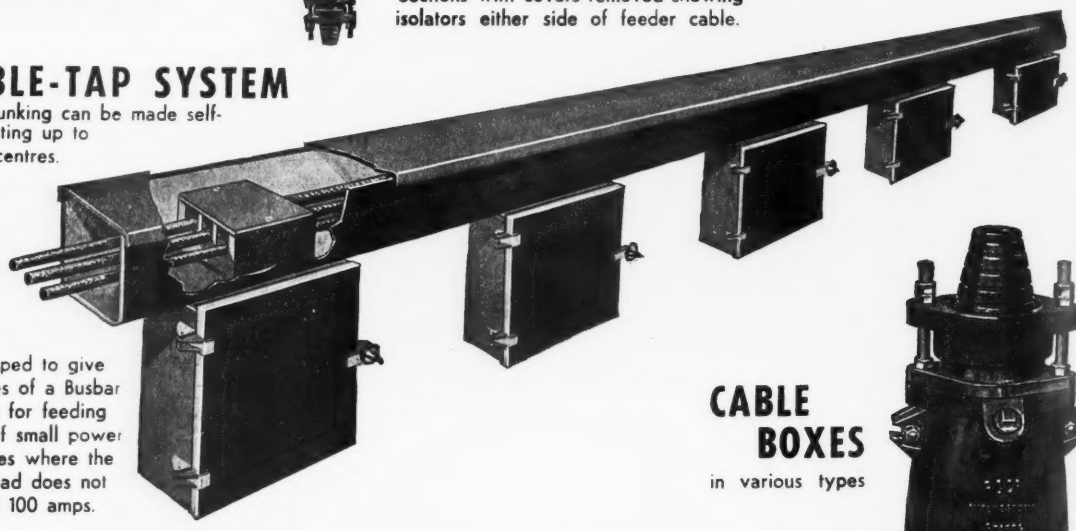
The trunking can be made self-supporting up to 20 ft. centres.



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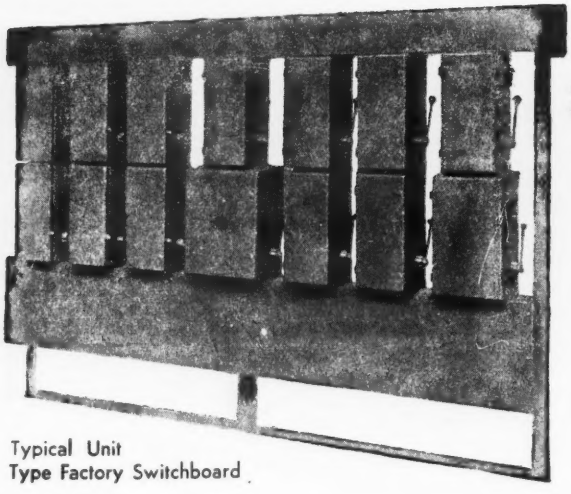
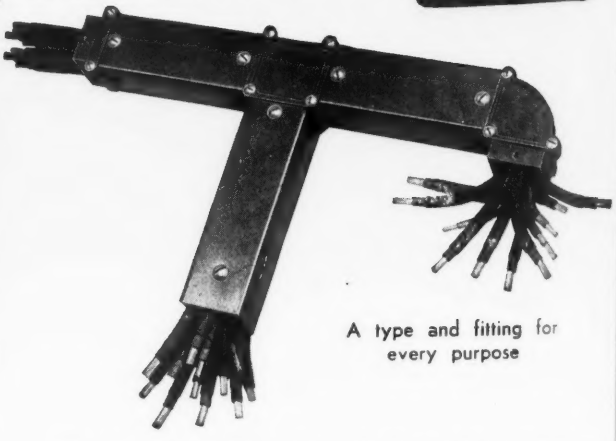


Typical Unit
Type Factory Switchboard

CABLE TRUNKING



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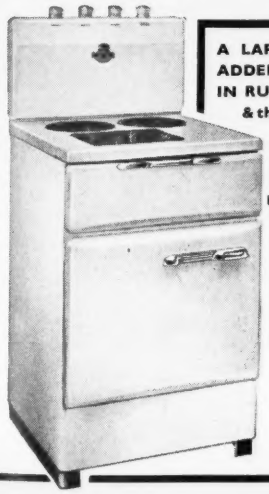

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2960 cu. ins. oven capacity. Loading 2.1 kW.

EYE-LEVEL CONTROLS out of the children's reach, too.

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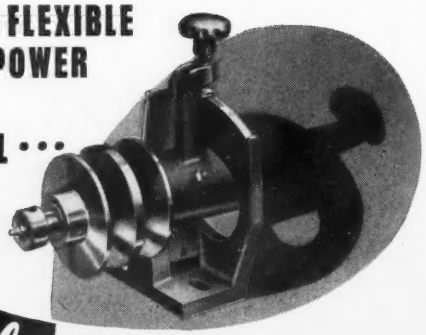

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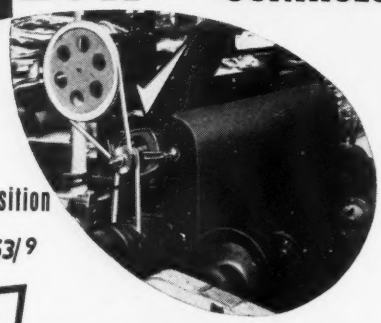

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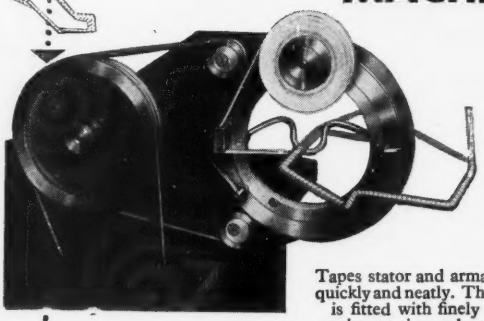
"MDC Quickway" TAPING MACHINES



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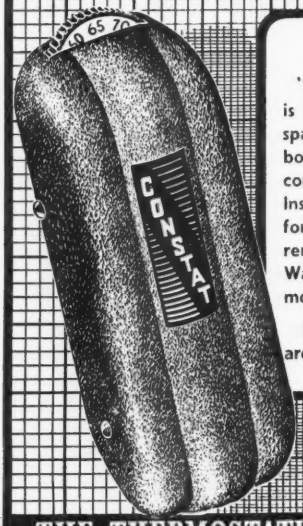

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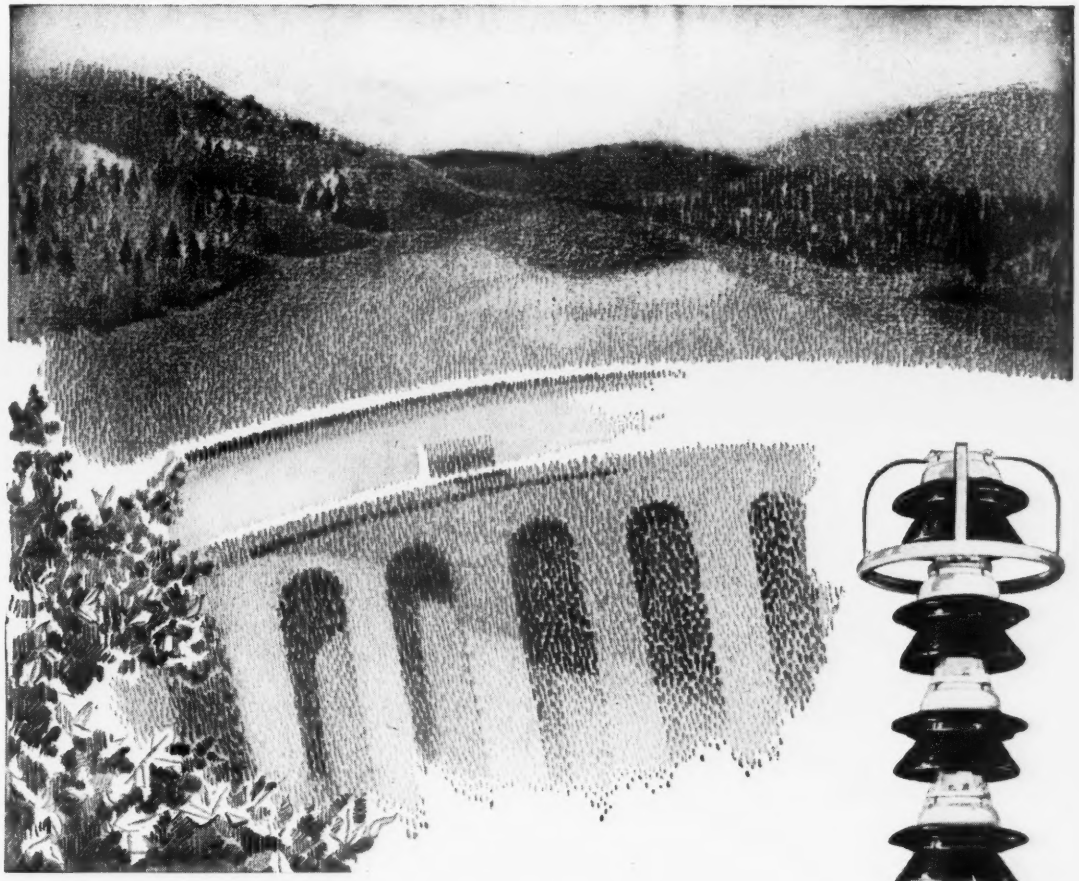

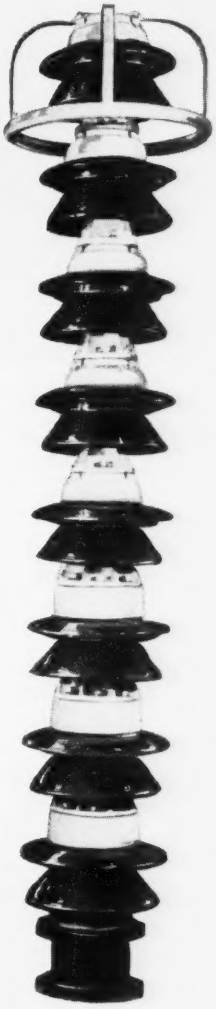

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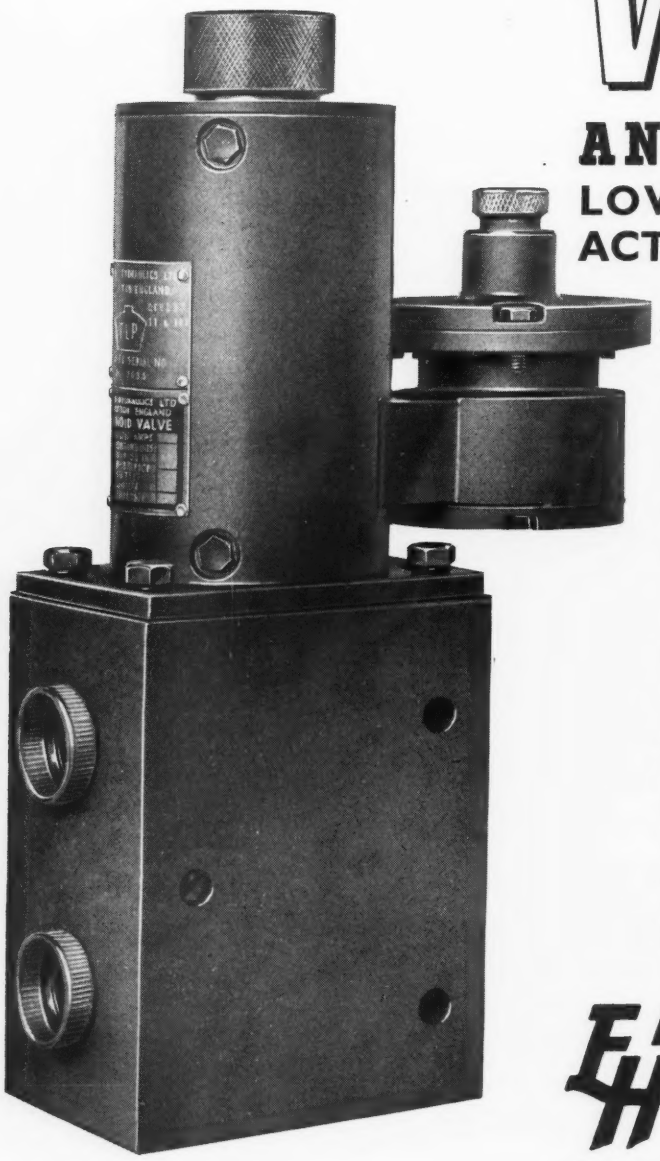

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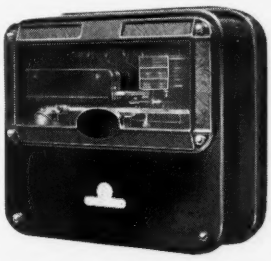

Type AMJ/P/2, double element, rolling ramp pattern, projecting mounting

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Fig. 57 Prices on application
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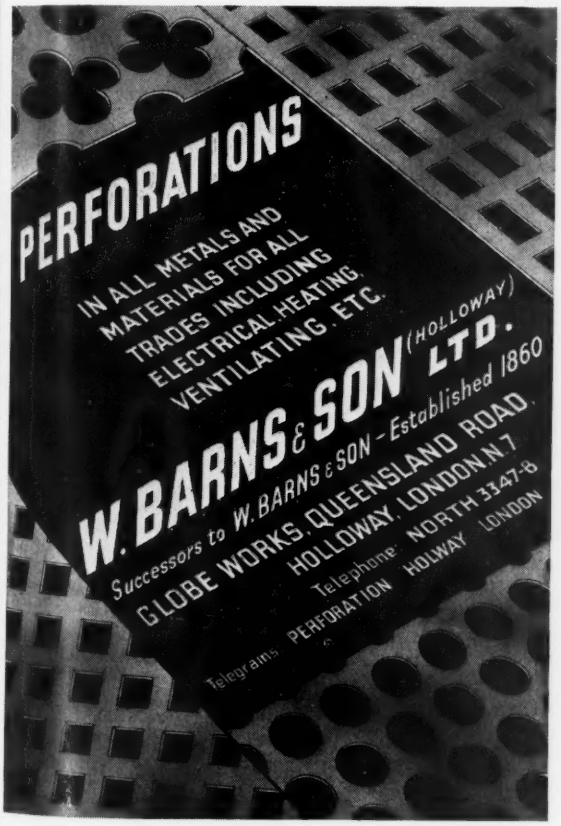
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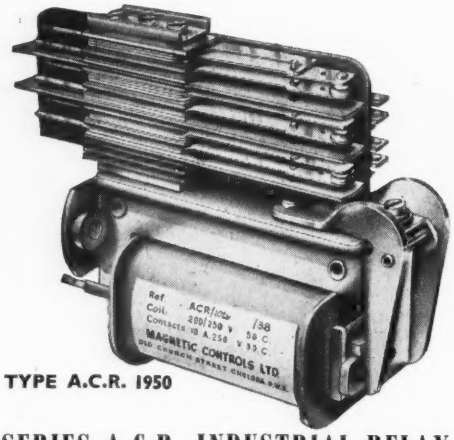

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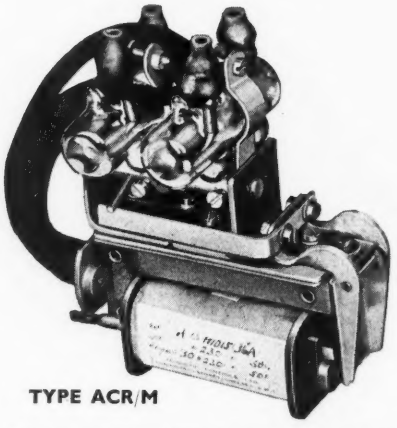

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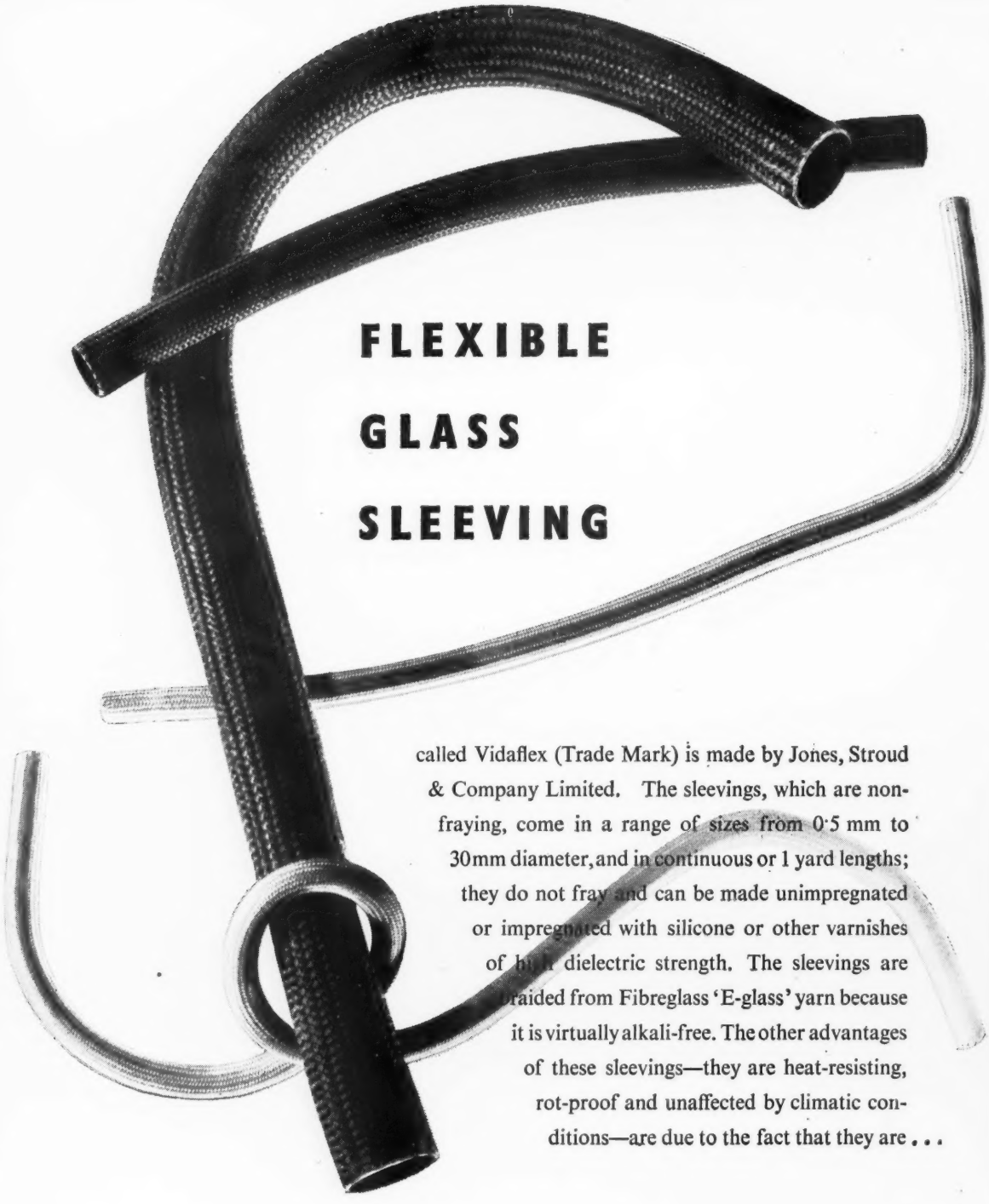

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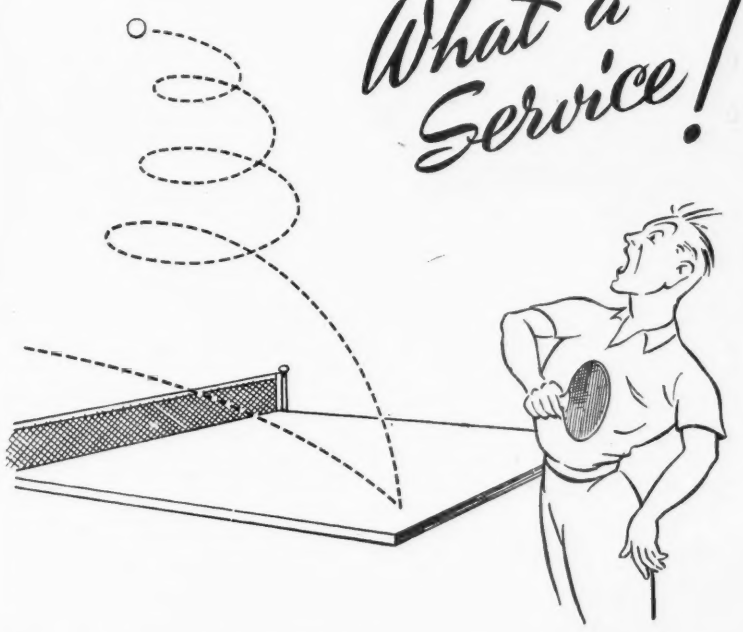

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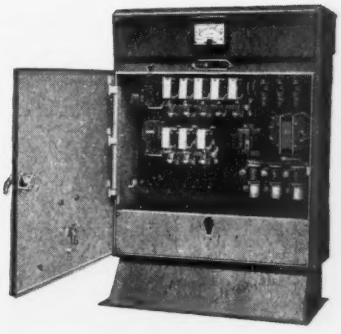

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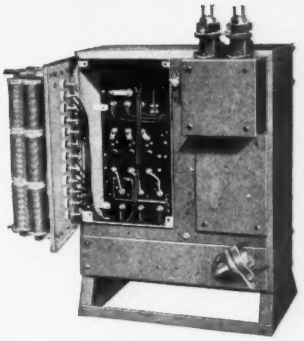

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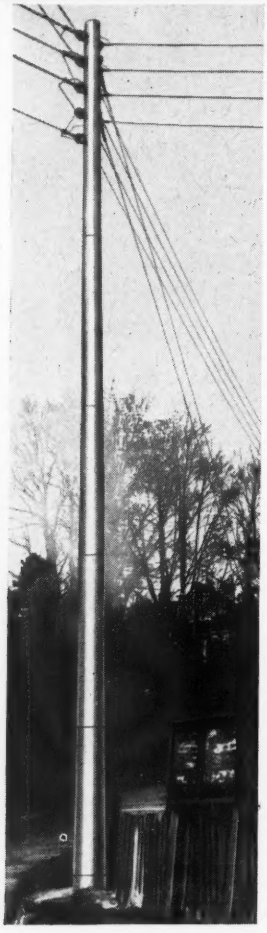

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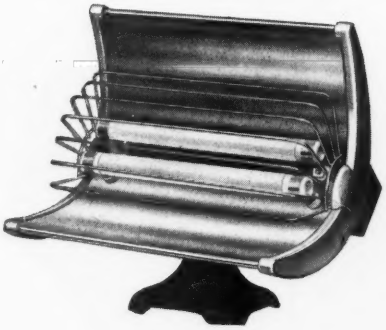

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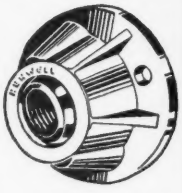

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19 NOVEMBER 1954

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VOLUME 155 ✧ NUMBER 21

Eighty-Second Year of Publication

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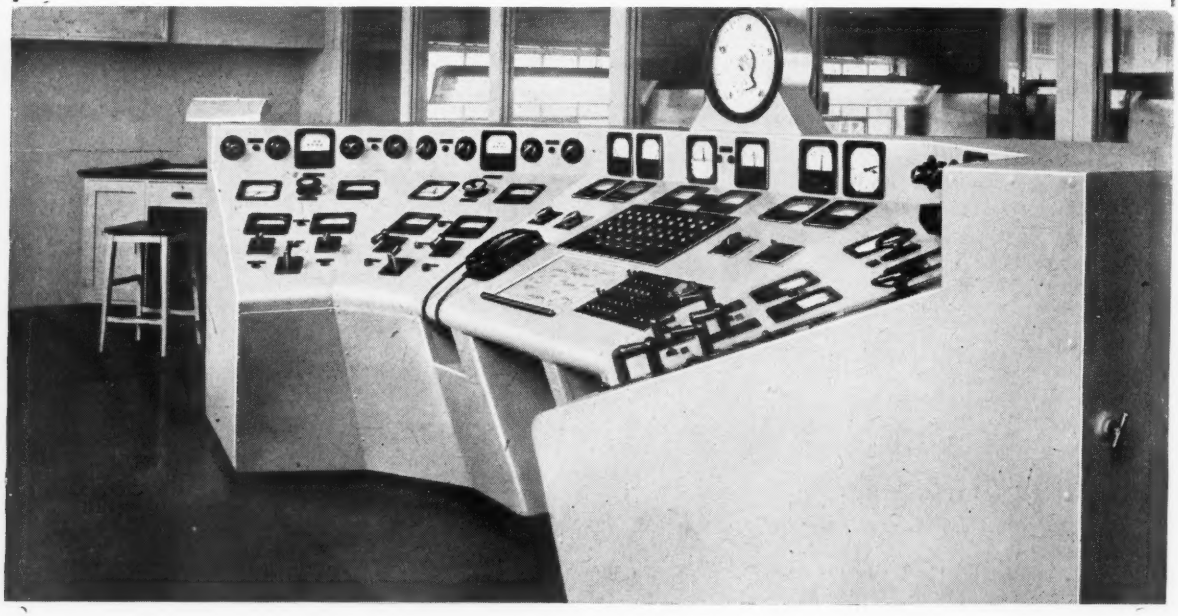
The panel instruments were supplied by Everett Edgcumbe.



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19 November 1954 Vol. 155 No. 21 Established 1872

Fair to All

TWENTY-ONE years ago the Electrical Fair Trading Council was formed and a few months later issued its first printed Policy. The Council's " coming-of-age " provides an occasion for explaining again what it stands for and how far it has succeeded in its aims. In this issue Mr. A. S. Lowe, the Council's secretary, gives an account of its origin and history; later articles will assess its achievements and the economic effects of the operation of the Fair Trading Policy.

In his article Mr. Lowe shows that the immediate urge towards the formation of such a body came from the provision of the 1926 Electricity (Supply) Act giving municipal electricity supply authorities general powers to sell " electric lines, fittings, apparatus and appliances " at not less than the recognized retail prices and to " install, connect, repair, maintain and remove the same." It was envisaged that the manufacturing and trading industries, together with the supply authorities, would evolve methods of ensuring that the recognized retail prices were charged by those concerned. Unfortunately, the supply authorities decided to withdraw from the arrangement, which might have ended the whole conception had the other parties not decided that it was worth while carrying on.

Thus although the original plan was much changed there was established a regime which, it is claimed, has been successful in maintaining order in the industry. The Fair Trading Council has drawn up and operated a code of trading ethics which has ensured, in a large measure, that discounts represent a fair remuneration for services actually rendered and excludes those who render no service to industry or the public.

In the earlier stages the objects of the Council were said to include: " The regulation of business between all sections of the electrical industry. . . ." Later it was felt that the word " regulation " savoured of compulsion and was modified. All that the Council has done has been accomplished by voluntary means. There are no " black " or " white " lists, although there was a time when these were contemplated. Now it is recognized by all sections, including the electricity supply authorities, that the industry has a code of ethics from which all benefit and through which the public is better served.

THE THERMIONIC VALVE

At the Institution of Electrical Engineers and at University College, University of London, this week the jubilee of the thermionic valve has been celebrated. Fleming's stroke of genius in 1904 may not get full recognition in 1954 because, seen at this distance of time, his discovery looks simple and obvious. The rectifying properties of the valve were known from the previous work of Edison, Fleming himself, and many others. J. J. Thomson had already identified the electron, which carries the current, and Richardson had published his formula for electron emission. In 1904, also, Wehnelt patented a rectifier embodying the oxide coated cathode, which was later to assume greater importance. In fact the valve had excited the interest of scientists for many years. But it was Fleming who saw its possibilities as a detector for radio-telegraphy; thus it was lifted from the laboratory and became, in time, an instrument of everyday use and a subject of mass production.

ELECTRONIC PRODUCTION CONTROL

In the debate in the House last week relating to nuclear energy and the electricity and gas industries, the Minister of Fuel and Power, Mr. Geoffrey Lloyd, said the automobile industry was leading the way in intensive mechanization and that the next stage might well be for a score of machines to be linked and perhaps controlled by an electronic "brain." Such an idea is not really new, with or without electronics; comparable examples are the many interesting installations we have seen of sequence control. In some cases this has been effected by relay and contactor, that is, a forward movement itself giving the control for the later movement; while in other cases the same sort of principle is followed electronically. Regarding more direct production plant there is the new paper making mill at Guard Bridge near St. Andrews which was described in the *Electrical Review* of 6th November, 1953. Here is a case where a whole host of operations are controlled from an electronic "brain."

PUBLIC ENTERPRISE

Comparing the latest annual reports of the Gas Council and the British Electricity Authority in our leading article of 22nd October we repeated a belief which we have stressed frequently:—

> "By striving to improve its service to the public each industry keeps the other alert and gives the proper answer to those who advocate co-ordination, which might too easily mean stultification."

Although there were one or two doubters (notably Mr. Robens, former Parliamentary Secretary to the Ministry), the speakers in last week's House of Commons debate on the two industries appeared to hold this view. It was particularly pleasing to hear the Minister of Fuel and Power re-assert his belief in the efficacy of competition between gas and electricity. Mr. Geoffrey Lloyd had already made his attitude clear by removing the restrictions on advertising by the two industries last year. He said last week that the Government had decided to encourage them to compete actively with each other as much as possible "and with oil." It is not realized by those who decry the advertising of gas and electricity that although these are now nationalized they are competitive commercial services—not quite on the same footing as water. It is those who were responsible for nationalization who seem to be most perturbed by this "commercialism." They have to learn that a public body must still pursue some of the policies of private enterprise if it wants to succeed.

THE FURNACE LOAD

The I.E.E. paper of Mr. C. J. Beavis, summarized in this issue, goes further in its implications than describing the largest arc furnaces in the country for making calcium carbide. Particulars given of the works at Port Talbot, South Wales, in three issues of the *Electrical Review* in 1946 (7th June, 12th July and 13th September) indicate an annual consumption of the order of 250 million kWh, which is taken from the grid. It appears to be typical of those unpredictable cases in which new industries have come into being or older industries have been transformed by electrification to an unprecedented extent, which have caused future electrical demands to be so often under-estimated. This trend will no doubt be accelerated when the low running costs of nuclear power stations encourage the development of heavy loads at the high load factors that usually accompany them. This supports the view expressed by Mr. J. D. Peattie in his chairman's address to the I.E.E. Supply Section that no saturation of electrical demand seems probable in any future that can be envisaged.

SULPHUR RECOVERY

At the recent Institute of Fuel Conference on the removal and recovery of sulphur from fuel, reported in the *Electrical Review* of 5th November, it was shown in the general conclusions endorsed by the conference that 3 million tons of sulphur are contained in the coal consumed each year and that we recover only 5 to 6 per cent of this. It was also shown that 75 per cent of our sulphur requirements are imported. This suggests that it might be worth spending some capital on recovery plant, particularly in view of the conclusion drawn that the gas industry now recovers 40 per cent of the sulphur by effective means. All this prompts the question: Could recovered sulphur be regarded as a by-product of the electricity industry? But preliminary investigations suggest that recovery would be very expensive. If, however, the supply industry is to be forced into removing the sulphur from its flue gases, then the revenue from the sulphur as a by-product might well help to lessen the cost of gas washing. Another aspect of the question which was raised by the British Electricity Authority in its annual report is that uneconomic recovery of sulphur from the flue gases could be justified in the case of an acute national shortage of sulphur, but this, of course, would call for subsidization.

TRANSISTORS and GERMANIUM DIODES

Production Techniques Employed by the G.E.C.

AN increasing number of applications is being found for both germanium diodes and transistors and most engineers are already fully familiar with the potentialities of these two devices. Until comparatively recently, however, they have only been made in the laboratory, but now that suitable production techniques have been developed a number of firms are manufacturing them on a comparatively large scale and with characteristics which can be controlled and reproduced with a high degree of accuracy. Typical of the manufacturers in this country is the General Electric Co., Ltd., and the purpose of this article is to outline the production methods which they are employing in the manufacture of germanium diodes and transistors at their Coventry works. Only a brief reference will be made to characteristics and applications since these have already been dealt with fairly fully (see *Electrical Review*, 2nd April, 1954, pp. 605–609, and 27th August, 1954, pp. 307–320).

First, we will deal with the manufacture of germanium diodes the bulk of the semiconducting material for which, in this country at any rate, is extracted from the flue dust obtained by burning certain types of coal. The method

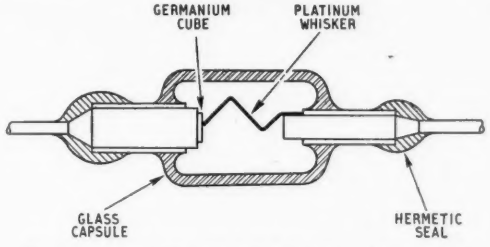


Fig. 1.—Cross section of a G.E.C. germanium rectifier

of extraction, developed jointly by the G.E.C. and Johnson, Matthey & Co., Ltd., yields from 0·5 to 1 per cent of germanium oxide from the dust. The oxide is reduced to germanium metal powder by heating in an atmosphere of hydrogen. The powder thus obtained is then melted in an inert atmosphere to form germanium ingots. These operations have to be controlled most carefully if germanium of the requisite purity for incorporation in rectifiers is to be obtained.

The germanium must, however, include a small amount of arsenic or antimony, the optimum value being of the order of one part in ten million. If the amount is appreciably less than this, the rectifiers have very high forward resistance. On the other hand a larger proportion of arsenic or antimony reduces the turnover voltage. Uniformity of characteristics thus requires accurate control of the very low impurity content. The only method of achieving this end is first to reduce the impurity to a level well below that finally required, and then to add controlled amounts. New techniques have been developed to attain pure germanium, and the raw material now used in production is probably in a form more pure than that of any other material.

The construction of a G.E.C. germanium diode is shown in Fig. 1 and the various component parts in Fig. 2. The body consists of a glass envelope fused to two nickel-iron alloy tubes of different diameters. These tubes and the special glass have been selected to give good sealing; that is, the thermal expansion of the metal and glass must be such as to give a strain-free seal which will withstand the severe conditions often imposed upon rectifiers in service.

The glass capsule is formed on a semi-automatic machine (Fig. 3) by fusing the two ends of the rotating glass and alloy tubes by means of an oxy-coal gas flame. The table on which four sets of parts are mounted is rotated when the glass-to-metal seal is complete. Considerable experience is necessary to determine the precise amount of heat required; too much will cause the glass to collapse and too little will not produce a good seal. A successful seal depends upon the formation of oxide between the alloy tubes and the glass. This oxide must be removed from

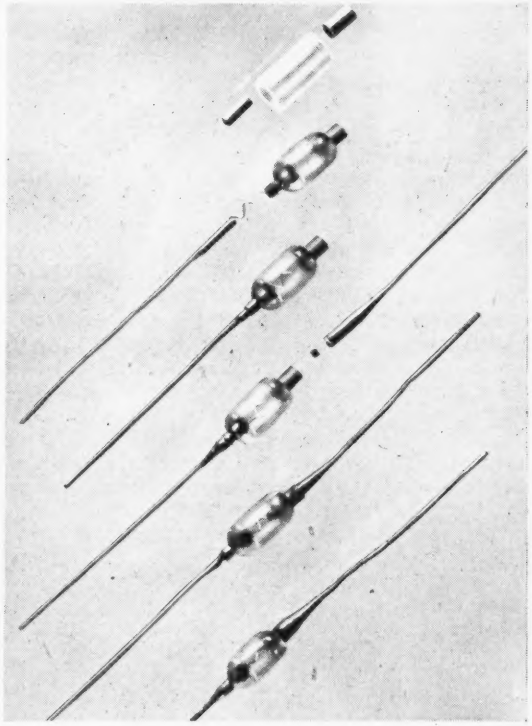


Fig. 2.—Various stages in the production of a germanium rectifier

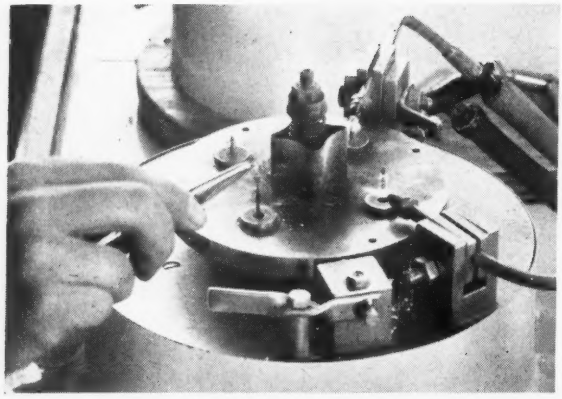


Fig. 3.—Fusing the glass capsule of the germanium diode to the alloy tube. An oxy-coal gas flame is used and the machine is semi-automatic

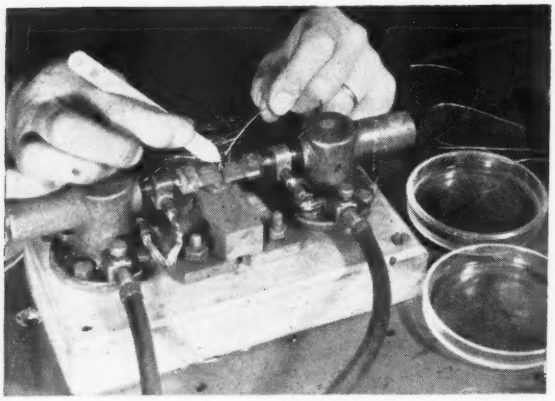


Fig. 4.—The germanium cube is mounted on the stub with a high melting point solder

the exposed parts of the tube so that a satisfactory weld can be made to it in a subsequent operation. The capsule is therefore chemically etched to remove the oxide after it has been annealed to remove any strains in the body of the glass.

The " whisker " and germanium are both mounted on nickel rods or stubs which have been swaged down to form connecting wires. The whisker wire, which is of 0·004in diameter springy platinum alloy, is welded to the whisker stub and crimped to the required length and form. It is important that the platinum wire is cut so that a sharp point is presented to the germanium. The whisker stub is then welded into the smaller of the two alloy tubes. If the glass-to-metal seal is not to be damaged during this operation, the weld must be carried out in a very short time; special welders have been developed which perform the operation in 0·01 sec.

The germanium which, as mentioned earlier, is prepared in ingot form, is cut into 0·03in cubes. Considerable wastage is involved, despite the use of the thinnest of cutting wheels, and because of the high price of germanium all the sludge from this operation is reclaimed for further processing. The germanium cube is mounted to the stub with a high melting point solder (Fig. 4) and the surface is ground and polished to form the rectification area. This area is then etched to form a suitable surface for the whisker contact.

The glass capsule with the whisker mounted in it and

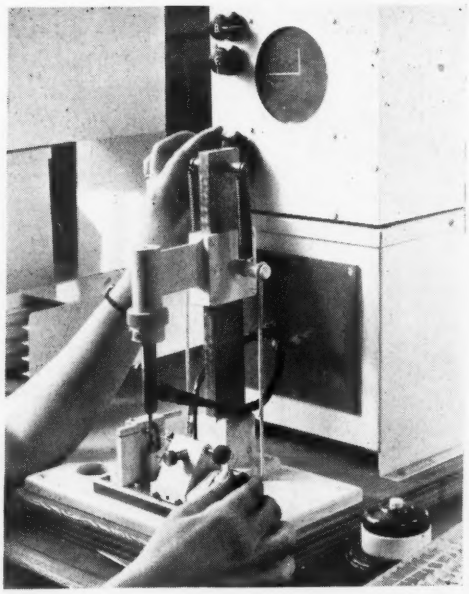


Fig. 5.—When mating the crystal and whisker, the crystal is advanced by a micrometer adjustment until it meets the whisker and then it is further advanced to obtain the correct contact pressure, the static characteristic being displayed on the oscillograph

the crystal soldered to its stub are now ready for assembly. The next operation, which is the most critical, is the mating of the crystal and the whisker, the equipment used being shown in Fig. 5. The crystal is advanced by the use of a micrometer adjustment until it makes contact with the whisker; it is then further advanced to obtain the correct contact pressure. An a.c. voltage is applied between the crystal and the whisker and the static characteristic is displayed on a cathode ray oscillograph. If this characteristic is considered satisfactory a forming current is passed through the rectifier and the crystal stub is welded into its sleeve.

The characteristic of a germanium rectifier is sensitive to the presence of water vapour, which makes it necessary for the capsule to be hermetically sealed. This is carried out by soft soldering the two ends, but not until the oxide formed during the welding process has been removed by a rotating scratch brush. To ensure that the contact is not moved by vibration, the face of the germanium is coated with a plastics cement immediately before assembly. This is subsequently polymerized by heating so that the whisker is held firmly on the face of the germanium. Finally the lead-out wires are tinned to facilitate the soldering of the rectifier in service, and the body is cleaned to remove any grease or flux.

The rectifiers are first segregated for turnover voltage by the use of the circuit shown in Fig. 6 which displays on a cathode ray tube the characteristic curve of the rectifier under test. The diodes are then graded according to their reverse and forward resistances at various voltages by passing a fixed current through the crystal in the forward direction and measuring the voltage drop. This method is employed in preference to measuring the current at a fixed voltage owing to difficulties in obtaining current meters whose resistance is low compared with that of the rectifiers. The reverse resistance is measured by applying a fixed voltage in the " no-flow " direction and measuring the current passing through the rectifier. Diodes intended

for use at high frequencies, e.g. television sound and video detectors are given a rectification efficiency test at 45 Mc/s, since d.c. measurements do not always predict accurately the behaviour at high frequencies.

To ensure that the rectifiers are suitable for operation under severe climatic conditions all germanium diodes are placed in a humidity cabinet for seven days. The temperature varies cyclically from 35 to 50 deg C and the relative humidity rises from 50 to 99 per cent, which represents more vigorous conditions than are likely to be experienced in the tropics. Quality checks and life tests are carried out on a percentage of the rectifiers produced (from day to day) in the laboratory, thus ensuring the high standard of reliability expected.

Turning now to the point contact transistor, the germanium used here must be of the highest quality so single-crystal material is used. This germanium is obtained by growing a crystal with a uniform lattice from molten germanium similar to the slow-cooled material used in the manufacture of diodes.

Each individual sample of germanium is subjected to vigorous physical and electrical inspection before use and having passed these tests it is cut into slices which are then ground to a predetermined thickness. The slices are subsequently cut into small wafers, the sides of which are 0·040in long. The cutting and grinding operations are very exacting since even the edges of the crystal, which are remote from the points of contact, must be free from splintering. Each wafer is then soldered, using pure tin at a controlled temperature, to a nickel stub which has been swaged to form a lead-out connection. It is this stub which forms the base of the triode.

During machining and grinding, structural disformation of the crystal surface takes place so it is essential that the layer of germanium so affected should be removed by chemical means and the true crystal structure exposed. This is done by using a very active chemical etch, after which each crystal is inspected under a high-powered microscope for correct crystalline formation and complete cleanliness. After the crystal has been so treated, strict precautions are taken to ensure that no subsequent contamination or damage to the surface can occur. The crystals are stored in desiccators and used within a few hours of etching.

The physical requirements of the triode are that it should be small and resistant to mechanical shock, humidity and corrosion. To satisfy these conditions the construction illustrated in Fig. 7 has been adopted. The centre tube of nickel is embedded in a phenolic moulding of low water-absorption and low thermal expansion. Into two holes of this moulding are bonded two tinned-copper support wires, reinforced by small nickel eyelets. The wires are soldered into these eyelets and a synthetic resin, of high mechanical strength and adhesive power, fixes the eyelets into the moulding.

The two whiskers are cut and formed from 0·006in diameter wire, the collector from phosphor bronze and the emitter from beryllium copper. The shape of these whiskers is extremely critical and the greatest care is taken in cutting them to ensure that a very sharp chisel point is formed on each, since this is essential for the intimate contact between the whisker and the germanium. The shape and orientation of these points are shown in Fig. 8.

After cutting and bending, the whiskers are chemically washed and given a very thin coating of anti-corrosive grease to ensure that the chisel point does not lose its sharp edge due to atmospheric corrosion. The next step is the assembly of the whiskers to the body.

It is essential for the correct functioning of the triode that the whiskers should be accurately spaced within 0·003in of one another on the crystal surface. Hence, the operation of assembling the whiskers to the body and the presetting of the 0·003in gap between the chisel points is hypercritical. It is performed on a very delicately adjusted jig and requires considerable experience on the part of the operator. The whiskers rest in the jig (Fig. 9) and are soldered to the support wires. During this operation no strain must be imposed on the whiskers so that, when the assembly is removed from the jig, no

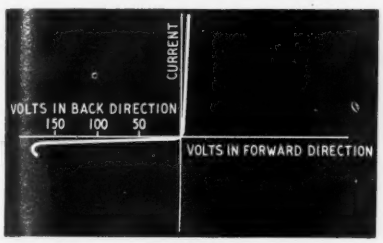


Fig. 6.—Testing circuit for a germanium diode, with a typical trace obtained

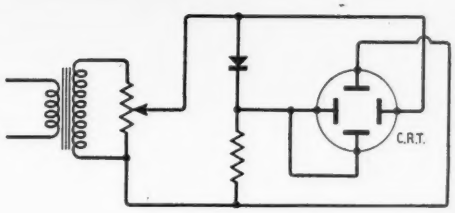
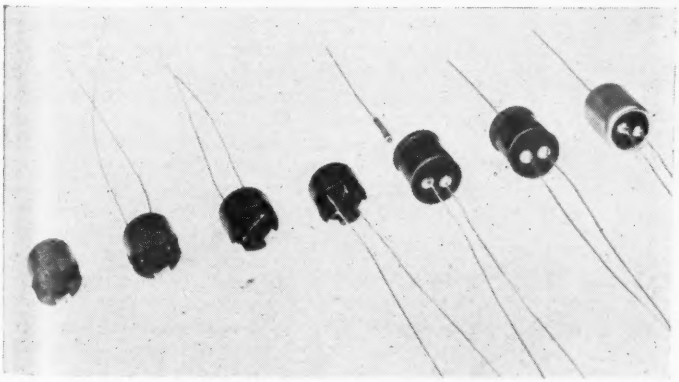


Fig. 7.—Various stages in the production of a G.E.C. point contact transistor



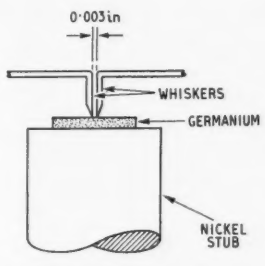
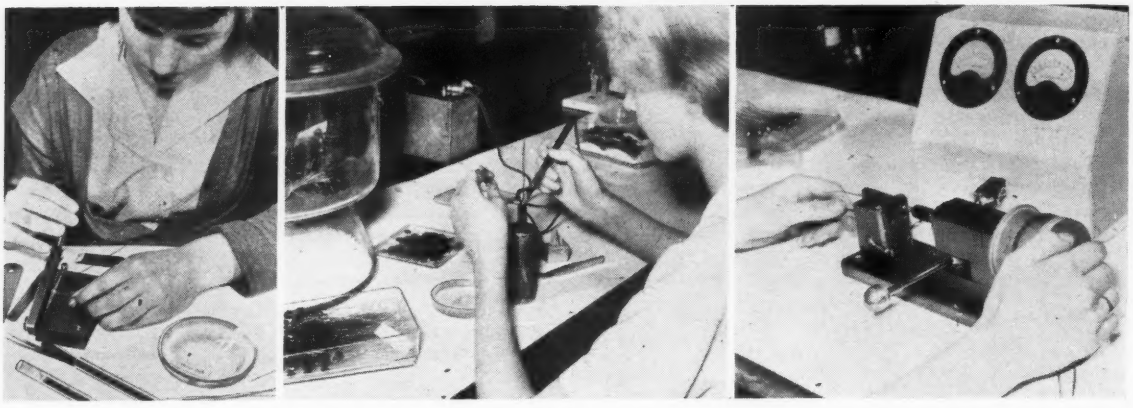


Fig. 8.—Diagram showing the shape and orientation of the whiskers relative to the germanium in a transistor



Left: Fig. 9.—The whiskers of the transistor are soldered to the support wires in a delicately adjusted jig, every care being taken to ensure that no strain is imposed on the whiskers during this operation. Centre: Fig. 10.—The emitter and collector leads are threaded through the brass eyelets and then soldered to them. Right: Fig. 11.—The germanium crystal, mounted on its nickel stub, is introduced to the body of the triode on this apparatus, which ensures correct contact pressure between the whiskers and the crystal

deformation of the whiskers is produced. After the whiskers have been soldered to the support wires the assembly is chemically washed and the whisker gap inspected, using a shadow-graph with a high magnification, to ensure that the previous operation has been performed satisfactorily.

The whisker support wires are then fed through the remaining two holes in the moulded body. The wires are thus folded back on themselves in a manner that prevents any mechanical shock or heat experienced by the parts of the wires acting as lead-outs from being transmitted directly to the whiskers. This also brings the emitter and collector leads opposite to the base lead, making the transistor substantially easier to connect into circuitry.

Neoprene-phenolic washers, which seal the ends of the triode, are then fitted to each end of the body. These washers have brass eyelets embedded in them, the ends of which are turned down and dug into the neoprene, thereby providing a moisture-proof seal. The emitter and collector leads are threaded through the eyelets and are soldered to them (Fig. 10) after which the eyelet in the other washer is soldered to the nickel tube which, as previously mentioned, is moulded into the body.

The assembly is then ready to receive the crystal, which is already mounted on its stub. This critical operation is carried out on the apparatus illustrated in Fig. 11. The stub is advanced through the centre tube by means of a micrometer-head until both whiskers make contact with the crystal. Having made contact, the crystal is advanced a predetermined amount to ensure the correct contact pressure, which is essential for mechanical stability and good electrical performance.

As the contact must be free from mechanical vibration, the surface of the crystal is coated with an adhesive cement immediately before assembly. This cement is then polymerized to form a strong mechanical joint between the whiskers and the face of the crystal.

The hermetic sealing of the triode is the final step in the assembly. An aluminium tube is fitted over the body and the edges are embedded into the neoprene-phenolic washers. The joint between the base lead and its associated eyelet is soldered to complete the sealing. The triode is then ready for electro-forming and testing.

The strictest precautions are observed to ensure the highest degree of cleanliness, since dirt, moisture, or any chemical contamination would be extremely detrimental to the electrical properties of the germanium. The components and sub-assemblies are chemically washed after each operation and subsequently stored in dust-proof containers and desiccators to prevent any possible contamination by atmospheric impurities, etc. As a further precaution, the storage time of the sub-assemblies is kept as short as possible to minimize the possibility of deterioration.

To obtain good characteristics and stability, the collector undergoes selective electro-forming, using the equipment shown in Fig. 12. Electro-forming is progressively increased until, with 1 mA flowing through the emitter, the collector voltage for a collector current of 2 mA is less than 3 V.

Fig. 12.—The collector in the germanium transistor is subjected to selective electro-forming, which ensures good characteristics and stability

When this condition is achieved, the following parameters are checked:—

(1) At −10 V on the collector, the collector current must change by more than 2 mA for a 0–1 mA change in emitter current (i.e., a current gain greater than 2).

(2) Collector current at −30 V with no emitter current flowing must be less than 2 mA.

(3) A collector voltage of at least −30 V must be possible without instability when the emitter is short-circuited to base.

This is the specification for the GET. 1. Using a similar mechanical arrangement, the GET. 2 which is suitable for low voltage operation, is electroformed until, with 3 mA flowing through the emitter the collector voltage for a collector current of 5·5 mA is less than 1·8 V. When this is achieved, the following parameters are checked:—

(1) At −10 V on the collector, the collector current must change by more than 2·5 mA for a 0–1 mA change in emitter current (i.e., a current gain greater than 2·5).

(2) Collector current at +10 V with no emitter current flowing must be less than 1·25 mA.

(3) A collector voltage of at least −25 V must be possible without instability when the emitter is short-circuited to base.

Having satisfied the above specifications, the triodes are temperature cycled several times between room temperature and +60 deg C. Following this test they are run at a collector dissipation higher than the rated figure for several days and then left in storage for a considerable time before the above mentioned parameters are re-checked prior to despatch. Thus before being released for distribution the triodes have undergone rigorous heat, operation and shelf tests.

New Equipment for Radiotherapy

Installations at the Christie Hospital and Holt Radium Institute

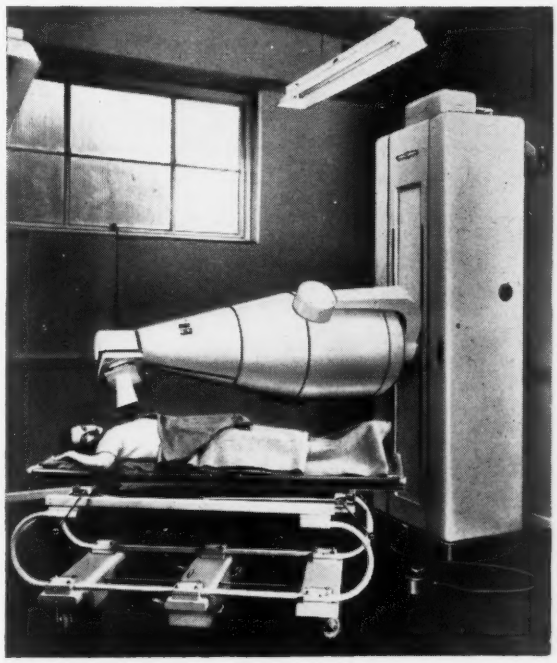
FOR some time now the Christie Hospital and Holt Radium Institute, Manchester, has been one of the foremost centres for the treatment of cancer. Radiotherapy is the most extensively employed method, being applicable to a large proportion of cases, and about one-third of these are cured.

In its normal therapy department, the hospital has for many years employed a number of Metropolitan-Vickers equipments, and much of the present routine treatment is carried out by four pre-war 250 kV equipments and one 500 kV equipment. They are supplemented by a 300 kV "Resomax" equipment manufactured by Newton Victor, Ltd. These facilities have recently been extended by the construction of a new building provided by the Medical Research Council and housing a unique collection of therapy apparatus. It includes two new "super-voltage" machines supplied by Metropolitan-Vickers; a travelling-wave linear accelerator and a betatron producing 4 MeV and 20 MeV X-rays respectively. In addition there is a second "Resomax 300" for control purposes. The betatron is a gift from the Metropolitan-Vickers Electrical Co., Ltd.

In the radiotherapy of cancer, it is often necessary to treat a growth which is deep in the body. To do this, an adequate dose of radiation must be delivered to the tumour area, an aim that is achieved by a number of X-ray beams all directed at the growth from different directions. The more penetrating the X-rays are, the fewer the beams that have to be used or the smaller the dose that each beam gives to the skin through which it enters the body. There has, therefore, been a demand for more penetrating beams, that is for higher generating voltages. Radiation of extremely high energy has however some disadvantages, and, to quote one example, even the increased penetration in tissue may lead to difficulty due to increased exit dose (that is the dose given to the skin at the point where the beam leaves the patient's body). The optimum energy is by no means sharply defined, but improved results can be expected with energies of some millions of electron-volts. The machines now available at the Christie Hospital will enable this matter to be investigated more fully.

The main feature of the betatron is a large a.c. magnet, whose central limb has specially shaped pole pieces between which is inserted a continuously evacuated glass toroid. The magnet is excited from a 150 c/s tripling transformer fed from three-phase mains. Electrons are injected into the toroid by a small electron gun (60 keV), which is pulsed to this voltage for 4 μsec when the magnetic field between the poles is at an appropriate very small value and thus sends a stream of electrons circling round the "doughnut." As the magnetic field increases sinusoidally the electrons circulate

"Resomax 300" X-ray equipment made by Newton-Victor, Ltd.

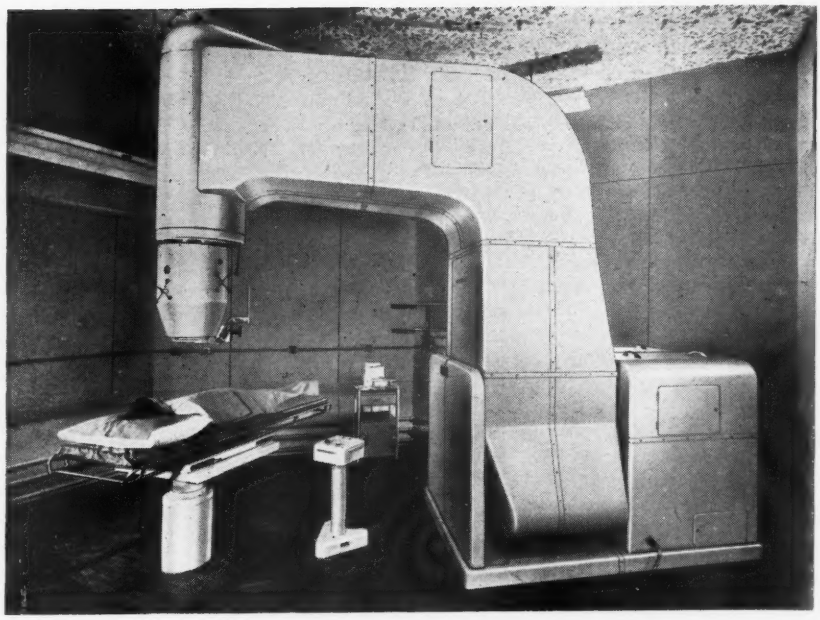


round the doughnut on an orbit of 19 cm radius, and for each revolution gain 80 eV of energy by magnetic induction. The electrons reach their maximum energy in $\frac{1}{600}$ sec, during which period they travel nearly 300 miles. At this stage the orbit is expanded so that the electrons spiral outwards and hit a small platinum target attached to the end of the gun. The X-rays are produced in the forward direction in a relatively narrow cone and occur as a series of 2 μsec pulses 150 times per second.

To reduce the power consumption, a resonant circuit is used in which the magnet is paralleled with a 1,600 kVA condenser bank so that it is only necessary to supply the losses of the magnet, which amount to about 20 kW. The magnet, which weighs $7\frac{1}{2}$ tons, can be rotated through 120 deg so that the X-ray beam can be set at any direction from 15 deg above the horizontal down to 15 deg beyond the vertical. The framework in which the magnet is held can be raised or lowered through a distance of 7ft.

Radiation from the machine is applied to a patient through a beam-defining device or collimator, into which different treatment cones are fitted according to the field shape required. The X-ray yield of the betatron before the insertion of compensating filters is 100 röntgens/min at one metre from the target.

In the 4 MeV " Orthotron " the electrons are accelerated by the action of an axial electric field associated with a radio wave propagated inside a corrugated waveguide. To obtain the high electron energies required, high fields in the corrugated waveguide (of the order of 30 to 40 kV/cm) and hence very large radio power fluxes, of the order of megawatts, are necessary. Such considerations enforce pulse operation of the equipment, and, since the free-space wavelength may conveniently be 10 cm, operation becomes similar to that of pulsed radar equipment. The accelerator guide is only 1 metre long. This has made possible the use of an adjustable mounting which can easily be swung to any angle required for clinical treatment, and the X-ray beam is in line with the accelerator.

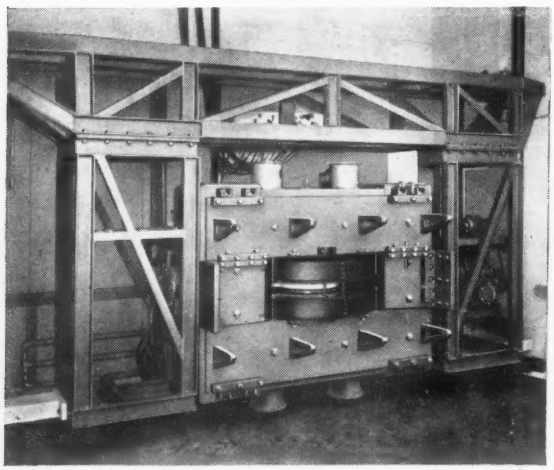


The 4 MeV " Orthotron " with X-ray beam in the vertical position

The mounting is arranged so that the machine can be moved to any angle required on a 135 deg arc lying in a vertical plane and centred at the normal treatment position for the patient. The axis of rotation coincides with the treatment point 100 cm from the target, a convenient arrangement for setting up a 100 cm target-skin or target-tumour distance as required. The accelerator overhangs its support by 6ft to give adequate room for setting up the patient. Used in conjunction with a couch with movements complementary to those of the machine, it is easy to set up patients quickly and accurately.

It is perhaps interesting to compare the outputs of the megavolt equipments just described with that of radioactive sources. The 4 MeV " Orthotron " produces, at considerably higher energy, an output some ten times greater than that of a 1,000 curie " cobalt 60 " source, which is itself 150 times more powerful than any radium unit in the country. As a source of X-rays the " Orthotron " is in fact equivalent to about 50 lb of radium. The betatron is in this respect somewhat less potent, the figures being about one-third of those given above. It should, however, be remembered that X-rays from the betatron are of considerably higher energy than the radiation from radium.

Metro-Vick 20 MeV betatron during installation at the Christie Hospital and Holt Radium Institute



Gases from Arcing in Insulating Oils

Among recently issued publications of the Electrical Research Association, Report Ref. G/T260 " Note on the Nature of Gases Liberated during Arcing in Oil Circuit-Breakers," by C. E. R. Bruce, M.A., B.Sc., M.I.E.E. (price 6s), gives in concise tabular form E.R.A. and other data on the composition of gases evolved by arcing in insulating oils. The E.R.A. data already given in Ref. G/XT35 are amplified and in particular, the few results obtained with a naphthene-base oil are quoted.

Electrical Fair Trading Council

A Historical Survey

By A. S. LOWE (Secretary to the Council)

IT is fitting that on the twenty-first anniversary of the inception of the Electrical Fair Trading Council, the genesis of the events which led to the formulation of the Fair Trading Policy and its adoption by the industry should be set down.

First it is necessary to understand and appreciate the state of affairs prevailing before the passing of the Electricity (Supply) Act, 1926. The suppliers of electrical energy comprised the municipally-owned undertakings, the privately-owned companies, as represented by the Incorporated Association of Electric Power Companies, the London Electricity Supply Association and the Provincial Electricity Supply Association.

Parliamentary sanction was necessary before the municipal undertakings could engage in activities other than the supply of energy. The companies, however, were under no statutory restrictions in respect of any other activities in which they wished to engage such as manufacturing, contracting and retailing. Many Bills had been promoted in Parliament before 1926 by various municipalities to secure for themselves additional powers.

Mr. A. S. Lowe

Matters came to a head with the proposal to set up a Central Electricity Board. The Bill then introduced gave general powers to all municipalities to engage in electrical contracting and retailing. It was feared by some that this might result in municipalities indulging in unfair trading by subsidizing their contracting work and retailing from their electricity revenues. Accordingly in the committee stage, strenuous (and successful) efforts were made to include protective amendments and the final Act included " Clause 48—Sale of Fittings." This clause provided that the municipalities should charge for their electrical contracting on a proper commercial basis and to supply fittings to their own consumers only, at not less than recognized retail prices. Contractors acting for the authorities' own consumers could also be supplied with fittings at not less than the recognized trade prices.

Statutory Committee

The Electricity Commissioners were required by the same clause to appoint a Statutory Committee to determine any questions which might be raised with reference to recognized retail or trade prices, or practices, and to assist those concerned with giving effect to the provisions of this section of the clause. Out of this Statutory Committee there arose four other Committees, " A," " B," " C " and " D," to deal with the detailed consideration of several major subjects and to the last named was delegated the subject of " Fair Trading."

Committee " D " comprising representatives of the manufacturers', wholesalers', contractors' and municipal supply associations, was inaugurated in 1927, and for almost the whole of its existence of six years, Mr. F. W. Purse, then chief engineer of the London and Home Counties Joint Electricity Authority, was chairman. The Committee had as its objective the preparation of a national agreement on trading principles, and the codifying of existing practices, so that wherever possible, the same principles would apply for all products. The task was a difficult one because of the opposing interests involved, and almost to the end of the discussions, it seemed doubtful whether there could be any fruitful results. Draft after draft was produced but finally the nettles were duly plucked, the general underlying principles agreed, and an embryo Policy was produced.

These were six critical years, and had it not been for the vision of the men who served on the Committee and their determination to overcome the innumerable obstacles, it is doubtful whether the industry would have become endowed with a Fair Trading Policy.

The Council

At the last stage, however, the representatives of the municipal electricity supply authorities were unable to commit themselves to the undertakings which were thought to be the necessary basis for the operation of a Fair Trading Policy. These objections rested quite genuinely upon statutory requirements and limitations. The other interests on Committee " D " felt very strongly that the objectives which the Committee had established during its long deliberations were worth while in the overall interests of the industry, and therefore decided to form a body representative of retailers, contractors, wholesalers and manufacturers to carry on the work.

The establishment of the Fair Trading Council itself quickly followed in October, 1933, under the chairmanship of the late Mr. D. N. Dunlop, then director of the British Electrical and Allied Manufacturers' Association (B.E.A.M.A.) and the first printed Policy emerged in 1936.

It is interesting to recall that the founder member-associations and their representatives were as follows:—

B.E.A.M.A.: H. A. Aston, D. N. Dunlop, T. W. Heather and V. Watlington.
National Electrical Contractors' Trading Association: T. E. Alger, L. C. Penwill and W. H. Walton.
Electrical Contractors' Association of Scotland: J. Allan and Walter Finlay.
Electric Light Fittings Association: W. T. Dean, C. Harvey and A. E. Iliffe.
Electric Lamp Manufacturers' Association: C. W. Sully.
Electrical Wholesalers' Federation: A. Albrecht, A. G. Beaver and G. Donovan.

Messrs. Heather, Iliffe, Penwill, Walton and Watlington have served continuously as members of the Council, while Messrs. Watlington and Heather can record an unbroken term of ten years in their respective offices of chairman and vice-chairman of the Council, to which they were elected in 1944. Mr. Walter Finlay of the E.C.A. of Scotland and Mr. Watlington were elected chairman and vice-chairman of the Council, respectively, upon the death of Mr. D. N. Dunlop in May, 1935.

The year 1936 stands out in the Council's history as one of great importance, in that the month of May saw the first Policy established in consultation with all the sections of the industry, officially published, bearing the title

" British Electrical Industry Fair Trading Policy for the Home Trade," and made freely available to all concerned. Five editions of the Policy have been published in all, and it has become the *vade mecum* of all those who trade in the products within its scope. By this means full regard has been paid to the changes and developments which have taken place in the industry from time to time and the Policy has been maintained as an up-to-date document.

No effort of this kind can ever achieve perfection, but it is clear from the wide support given to the Fair Trading Policy by all sections of the industry, irrespective of representation by trade association (constituent member or otherwise), that it commands respect and has been beneficial over the widest possible field.

It is not without significance that the influence of the Policy has spread overseas, and to-day eleven countries regularly receive copies of the Council's Policy and other publications. This is not to imply that a similar code of practice is being established in all these countries, but it can be recorded that in Australia, New Zealand and South Africa there is a desire to emulate the Mother Country in this respect. South Australia has had modified sections of the Home Policy in vogue for two years or more.

To-day, the Fair Trading Council has fourteen constituent member-associations. For this reason, coupled with the fact that the industry is still rapidly growing, the problems referred to the Council tend to increase and many are not easy to solve, and of some responsible for protracted discussions it is as Macaulay said:—" Men are never so likely to settle a question rightly as when they discuss it freely." Tolerance and compromise as befitting true democratic government are ever present in the free discussions of the Fair Trading Council, and it is in this atmosphere that the greatest common measure of agreement is sought and reached.

What makes the Policy so popular and why has it gained so wide a measure of support? The short answer would seem that it is entirely because it is based on commonsense and developed out of hard experience. The Council is justly proud of attaining its majority and looks forward with confidence to the future. The industry as it continues from strength to strength will be increasingly thankful for the forum which it has established in the Fair Trading Council. It is there that one common table is provided for the free discussion of industry's problems which can be conducted with mutual respect and confidence.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Different Outlooks

IT was with mixed feelings that I read your editorial of 8th October, dealing with the productivity report " Industrial Engineering," and its relationship to industry on this side of the Atlantic. I agree that the conclusions are apparently weak; I agree with your editorial comment, no other is possible. However, the humour of the whole thing is, that in my view the authors are, without knowing it, dead right. I say without knowing it, by reason of their phrase . . . " we hesitate to make a diagnosis. . . ."

Lest I be criticized for speaking of industry without experience, let me say that I am drawing a parallel between the electricity industries on both sides of the ocean. With these I have a fair amount of experience, and it is not too difficult to suppose that productive engineering is closely related. The aggressiveness of industry in Canada arises from the industrial atmosphere, incentive, competitiveness, and the other phrases quoted.

To establish my bona fides, and for no other reason, let me quote from my paper to the I.M.E.A.–B.E.A. Convention at Eastbourne in 1948. I argued for fast costing at the working level. Mr. E. R. Wilkinson in the discussion said that the human element was the fundamental of efficiency. And yet, in the cases of the four Area Boards of which I have up-to-date information, district engineers have to wait from three weeks to four months for construction costs. The productivity team, like others before it, calls attention to the " prompt issue of cost and performance figures." It advocates the use of electronics in this connection. In 1948 we only wanted punched cards, and one Area Board chairman told me: " Our conception of efficient accounting does not include the use of such methods."

The difference between the two countries is one of outlook. Nor is this outlook confined to any one class. In Canada the new housing estates show examples every night, of electric lamps slung on an array of wires which break every rule in the British (and Canadian) wiring codes. They illuminate the roofs and basements of new houses, while men work of their own free will, until 10 o'clock at night. Any builder can get men to work at single time rates on Sunday (though he will get more at double time). British bricklayers make jokes about the bad old times in Britain, as they lay a phenomenal number of bricks per day. They do it because they have a goal in front of them. It often is sufficient money for the deposit on a house, a new car, or to fetch the family over from Europe in three years.

When the team speaks of " transferable " characteristics, it should be realized that many of these bricklayers are British. Why can it not be done in Britain? It is because too many people would have to be convinced. Were the writer, with four years of watching the results of incentive and aggressiveness, to have to put it to work in Britain, he would not know where to begin. The unions must change their outlook. Increased profits are the cause of big wages, not an obstacle. A man must be able to tell his boss in a nationalized industry exactly what he thinks, without the fear that his career is finished if he gets out of step. The employee must lose his fear of being sacked. Drop the idea of testimonials and references for common or garden jobs, and give the man the alternatives: " Make good or go."

There should be more and more small industries, plenty of space for the individual to move around in if he hasn't yet found his niche. Municipalities should contract out their new building. The builders should subcontract their brickwork and their carpentry, so that everyone can increase his income by working fast. Thus everyone makes a profit out of the work. This is carried into the electrical industry by encouraging the private contractors to sell the cookers and water heaters, to lay cables, and in

many cases to do rewinding and repair work. The recital of these aims will no doubt bring feelings of nostalgia to the contractors in the electrical industry at Southend-on-Sea.* At the same time it will bring home to many the task which lies before anyone who attempts to reintroduce aggressiveness to Britain.

Those responsible for going to England to hire labour, find that they cannot persuade the right types to emigrate in sufficient numbers. They state that the average Briton is "wedded to the Welfare State." This dependence on the State is the direct negative of the spirit the teams are seeking. Among the many ways of helping to overcome it, the universities might lengthen their courses to include an extra year. This would allow a four or five month break in the summer. Industry must then be willing to take students on for this period, and to pay them sufficient to meet their expenses for the rest of the year. Thus you could avoid the State scholarships which teach the student his dependence on the State from his earliest days.

And so I think the answer to the team's quest really does lie in the lack of stratification in society, in incentive, etc. But the old clichés hide something which I do not think can be transferred.

Willowdale, Ontario. ROYDEN C. GOLDING.

* Before going to Canada Mr. Golding was construction engineer, Essex Sub-Area, Eastern Electricity Board, having been borough electrical engineer of Southend until nationalization of the industry.

Treatment of Applicants

IN my quest for a new post which offers genuine prospects, I have found cases of appalling callousness on the part of those concerned with the appointment of new staff. Despite the fact that prospective employers have known at the outset that they are in touch with a chartered electrical engineer with a sound record of achievement, the attitude too often is one demanding everything from the applicant but offering nothing of any consequence in the way of encouragement and satisfaction.

By using the word "satisfaction" I am not just implying the offer of a low salary, although this is all too frequently the case. One firm recently advertising for "a senior engineer with A.M.I.E.E. or equivalent and extensive experience" offered me a salary identical with a nationally advertised one for youths with no experience or qualifications just out of the forces. I have met employers and representatives of employers who, while insisting on A.M.I.E.E. status, promptly sneer at it during the first interview.

A further annoyance is delay and discourtesy. I have attended an interview in August, followed by a short-list interview in November, only to be informed as late as the middle of January that the post was filled. In another case, and this concerned a leading firm, I attended two interviews last July, but now in the middle of November, I have had no decision one way or the other, although I was encouraged to believe at the second interview that I was the suitable applicant.

My most recent experience concerns a well known firm of repute, who, explaining by letter that the post is for a sales engineer in London, made it clear at the interview that the territory is in fact outside London. Their commodity is a specialized industrial product with many variations, yet when asked if I should have the opportunity of spending some time at their factory in the north to study the merits of their goods and the variations which they offer, they made it clear that it could not be arranged, and that I must start on the new territory the first day of appointment. This post I contend suggests a canvasser rather than a qualified engineer.

This ever recurring lack of respect and consideration for the qualified man is a discredit to those selected to appoint additional senior staff. In my case age is not yet against me, I have a sound record, I play fair and do not try to pull wool over employers' eyes simply to get a job. Many times, however, I find an attempt is made to pull wool over my eyes. Fortunately not all executives and directors are so lacking in decency, but it is a great pity that there is this minority.

"STILL HOPEFUL."

"Landlords'" Services

"REFLECTOR'S" comments concerning the attitude adopted towards so-called "landlords'" services (*Electrical Review*, 29th October) deal only with one aspect of the dictatorial treatment meted out by Electricity Boards on this type of service. I have recently encountered two other variants of the same theme.

The first concerned a very large commercial building in the West End of London which was originally constructed for occupation entirely by the owner. The building was constructed in sections to meet the fire regulations and each section was treated as a self-contained unit with a separate sub-switchboard fed by an armoured cable from a consumer's central main switchroom. Recently, some of these sections have been let to tenants as complete blocks and the London Electricity Board is metering at the sub-switchboards. Under the terms of the lease the tenants are required to make their own arrangements for services but nothing will persuade the L.E.B. that it is now supplying electricity over borrowed cables.

The second case concerns a new building being erected on the south coast. The lower floors of the premises, accessible from the main street, are being occupied by the owner. The top floor, however, is being deliberately constructed as a separate premises with separate entrance, staircase and lift, accessible from the street at the rear, and will in consequence be given a different address. The Southern Electricity Board insists on placing the cut-outs for the top floor service in the owner's intake switchroom.

Walton-on-Thames. C. B. FAULCONBRIDGE,
Consulting Engineer.

[The circumstances of the case referred to in the writer's first paragraph were explained in a letter in our last issue.—Editors, *Electrical Review*.]

Railway Electrification

I AGREE with Mr. Merritt (*Electrical Review*, 5th November) that Mr. Broom overstated the obsolescence of the steam locomotive, for which there is still a considerable place in British Railways, but I do not agree that electrification should be confined to heavily loaded suburban lines. The complete electrification of the Swiss Railways shows that there is no technical reason for any line not being electrified, but Switzerland has of course an abundant supply of hydro-electric power. The rapid electrification of the French railways, less heavily trafficked than our own, and with no special sources of power available, is a better example. There 50 c/s traction is rapidly expanding. This involves a much lower capital cost.

Electric railways might be vulnerable in time of war, but on the other hand, diesel and diesel-electric locomotives would be liable to be deprived of fuel. American friends confirm that diesel locomotives are noisy and emit fumes which penetrate the passenger coaches. I live near a railway on which electric trains run every minute at peak hours, but I never hear them, whereas steam trains cause some disturbance and the one diesel train a day shakes the house.

I hope diesel traction on the railways will be confined

to shunting locomotives and railcars for country branch lines. I am sure a bold policy of electrification of all suburban lines in all towns, and of all the busiest main lines would bring rewards fully justifying the high capital cost. The use of 50 c/s equipment for the less busy sections would reduce the capital cost, and would not prevent through running, as locomotives (or motor coaches) can easily be made to operate on both a.c. and d.c.

*London, S.W.*18. F. K. FARRELL, B.A., A.M.I.E.E.

Oil-filled Cable Leakages

IN his article on oil-filled cables in your issue of 8th October Mr. Ashton explained at great length the very ingenious developments which have been made in leak detection and location. Surely this is not the right approach to the problem of leakage from such cables ; rather the solution should lie in leak prevention.

Successful leak prevention has been achieved in many parts of the world by the application of cathodic protection to such cables. The earth currents set up by electrochemical and electric power systems can cause heavy corrosion and consequently high leak frequency. Correctly designed cathodic protection will, on the other hand, prevent these earth currents flowing in such a manner as to cause corrosion and thus protect the cable giving it, except for mechanical failure, an almost indefinite life.

This being so the cable sheath has to be designed to mechanical strength tolerances only with no extra wall thickness for corrosion allowances. The saving in material alone effected by this may more than pay for the low installation and maintenance costs of the cathodic protection, while the saving of costs which would have been caused by leaks is very large indeed.

*London, W.*1. JOHN H. MORGAN.

Standard Frequency Radio Transmissions

THE discussion on the three papers on standard frequency transmission which were presented at a joint meeting of the Radio and Measurements Sections of the Institution of Electrical Engineers and summarized in last week's issue of the *Electrical Review*, was opened by Dr. R. L. Smith-Rose (Department of Scientific and Industrial Research). The work described, he said, was necessary to keep this country in the forefront, a position which might have been lost to the U.S.A., and to secure world-wide coverage which would otherwise have had to be developed along the lines laid down by the American Bureau of Standards. The N.P.L., through the D.S.I.R., agreed to pay for the service and accept complete technical responsibility. The service was available to everybody, but the organizations possessing the requisite expensive and complicated apparatus to take advantage of it were few.

Mr. H. M. Smith (Royal Observatory) outlined the methods by which the Observatory performed its two functions of establishing the fundamental time required for the calibration of the frequency and time intervals and of monitoring the transmitted signals. The unit of time, he said, was defined in terms of the rotation of the earth, the rate of which was affected by appreciable variations and astronomers had now adopted a new system called "Ephemeris" time which in practice was measured by observations of the rotation of the moon round the earth.

Mr. R. J. S. Spilsbury (N.P.L.) said that it would be of great help to them to know that what was being done was what was wanted by serious users.

Mr. N. Lea (Marconi's Wireless Telegraph Co., Ltd.) asserted that the British system was perhaps superior to that in the U.S.A. Speaking as a user, he said that MSF (Rugby) provided a 1-hour signal which could be received with an accuracy of $\pm$ 2 in 10^9, while for 24 hours a day the figure was about $\pm$ 2 in 10^7. Thus an industrial laboratory having a number of well-tested oscillators could make frequency measurements at any time of the day to a resolution of 10^{-8} and develop oscillators to about the same stability. For oscillators stable to 1 in 10^9 for useful periods, the MSF service was not entirely adequate, and local oscillators stable for at least 24 hours to better than 10^{-9} were needed.

Capt. C. F. Booth (G.P.O.) expressed the opinion that equipment of the type described was essential for the effective use of the frequency spectrum in the most economical way. He hoped for the development of a frequency standard which was independent of the vagaries of the quartz crystal and drive circuit and for a means of translating some of the very high stabilities into relatively simple equipment which could be used in any radio station.

Mr. H. V. Griffiths (B.B.C.) said that they had found the MSF 60 kc/s transmissions very useful as a frequency reference with which they could conveniently compare their own standards.

The 200 kc/s Droitwich transmission was largely used in the U.K. and to some extent on the Continent for quasi-scientific purposes, mainly because it was on continuously. There was a need for some l.f. transmission in the band between 50 and 200 kc/s, where propagation was stable.

Mr. H. T. Mitchell said that the alterations made by the Post Office to the Essen ring had made it transportable over thousands of miles without affecting its performance. There were 38 such rings in use, including three in Australia, five in the U.S.A. and four in Canada.

Mr. J. Welgate illustrated by slides how the Royal Greenwich Observatory did the monitoring. The mean anomaly was just over 1 part in 10^{11} on an integrated frequency over $\frac{3}{4}$ hour. By making measurements at intervals of $\frac{1}{4}$ hour, one could get after 3 hour the integrated frequency difference between the received standard and two of their own standards, and also between their own standards directly.

Mr. P. P. Eckersley suggested controlling the frequency of the mains to accuracies equivalent to at least 1 part in 10^1, obviating the need to ring up TIM and increasing the sale of electric clocks.

All three authors replied briefly to the discussion. Dr. Essen said that last year they had received some 500 reports of reception, mainly from amateur radio enthusiasts. The 60 kc/s transmission, however, formed the standard in a large number of laboratories. A shortcoming was the short period of transmission, so that Droitwich was very useful. He mentioned that GVR 16 kc/s was now controlled by the same standard and giving a world-wide service with a precision of 1 part in 10^9, although, since it did not operate on continuous wave, it involved more troublesome reception techniques.

Industrial Terminology

Representatives from Austria, France, Germany, India, Italy, the United Kingdom, the United States, Russia, Yugloslavia and from seven important international organizations, met in Vienna in mid-October under the ægis of the International Organization for Standardization to discuss their differences of speech. The aim was to agree on the form in which terminology in the industrial field should be drafted, especially for use in technological glossaries, so as to facilitate the comparison of terms in the different languages. It is intended that terms used for world trade shall be short and clearly defined. Dr. L. Hartshorn (Dept. of Scientific and Industrial Research), with Professor R. O. Kapp, and Mr. Gordon Weston, technical director of the British Standards Institution, represented the United Kingdom.

A start has already been made. The I.E.C. vocabulary of electrotechnical terms, of which the second edition is now in course of publication after three printings of the first edition, can be regarded as the first of a series. It gives terms and definitions in the two official languages, English and French, and terms only in five other languages. A separate edition is produced in the Russian language.

Making Large Transformers

FACTORY EXTENSIONS AT WALTHAMSTOW

The new transformer shop

FOR many years, the Fuller Electrical & Manufacturing Co., Ltd., in association with Asea Electric, Ltd., has been making large high voltage transformers and, indeed, we are told that the first transformer designed for 132 kV to be made alive in this country was built at its Walthamstow Works. To meet both present day and future requirements for larger transformers for higher voltages, the company has just completed a new extension to its factory, which, costing half a million pounds, is planned to deal with units up to 400 kV and for the largest capacities.

The new building, which is 75ft high, incorporates a number of interesting features. To deal with the exceptional weights involved in these very large transformers, particular attention has been paid to the lifting arrangements and crane rails have been installed at two levels, the higher one to accommodate two 110 ton main hoists (each with a 10 ton auxiliary hoist) and the lower a 25 ton main hoist (with a 5 ton auxiliary) and a 50 ton main hoist. All this equipment is of Stothert & Pitt manufacture.

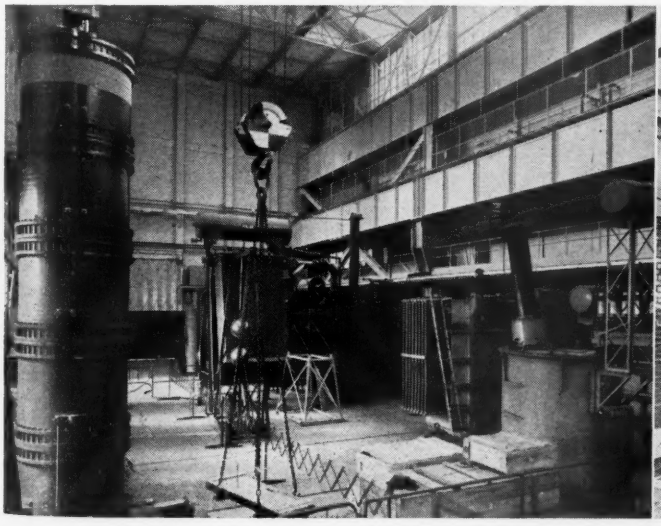
A new drying and impregnating plant installed incorporates the most up-to-date and practical equipment for the treatment of very high voltage windings and this will ensure that the finished product will meet the most rigorous technical requirements. An atmospheric drying oven for preheating before impregnation is equipped with a Keith Blackman fully automatic plant which is normally heated by hot water but has 70 kW of stand-by electric heaters. The system of fans, ducting and dampers permits any desired degree of recirculation.

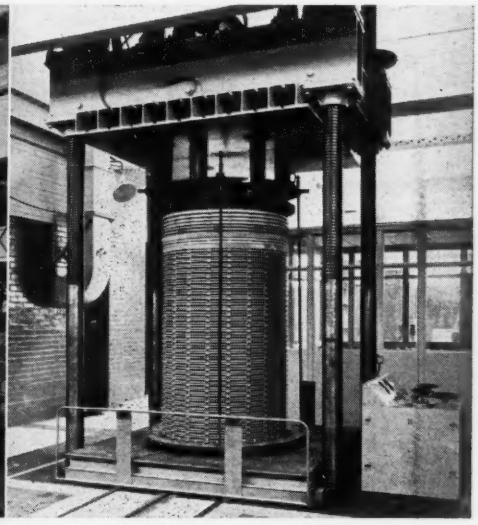
The new vacuum pot for the impregnation plant, which has been developed by the Fuller Company, and manufactured by the General Engineering Co., Ltd., is of unique construction and it provides treatment facilities for the largest units now envisaged. Similar to a unit which has already proved its effectiveness in the old factory, the vacuum pot is in a concrete pit sunk 22ft into the ground, the walls being tied to the concrete by steel links. No additional stiffening is necessary and the pot is allowed to move under expansion and vacuum. The plant was designed to achieve a vacuum equal to 2 mm pressure and in practice this can be reached in 2½ hr. Facilities are provided for alternate vacuum and heat treatment of the work by the circulation of hot air through the pot.

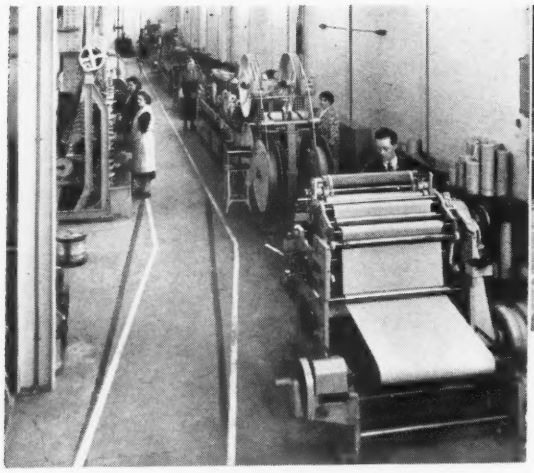
High vacuum filters are provided for the initial cleaning of transformer oil and complete dehydration and de-aeration are obtained by specially designed plant. A process control panel is to be installed to provide supervisory control of the operation of the equipment.

The windings of Fuller transformers are subjected to a special pre-shrinkage process to ensure there will be no movement of the coils even should the transformer be subjected to the forces developed under a dead short

Left: The test department in the new transformer shop. Right: A 200 ton press for transformer coil treatment







New department for insulating copper

Insulation cutting department

circuit. The new shop has been equipped with a 200 ton press easily capable of dealing with the largest coils.

For testing purposes, a plant having a capacity of 30,000 kVA is being installed and this has been designed to provide the maximum flexibility. The equipment will deal with all necessary power frequency tests and it will enable a number of high voltage transformers to be handled at the same time. For impulse testing, a new 2,000,000 V surge generator has been provided and this, together with its auxiliary transformer, is mounted on trolleys. The whole unit is, therefore, completely mobile and, when not in use in the test area, it can be returned to a recess in the south wall of the building. This, it is believed, is the first mobile set of its kind in the country and it obviously frees a considerable amount of production floor space which would, otherwise, be permanently occupied. If required, the test area can be doubled, the whole of the floor being covered with an earth mat to overcome induced current.

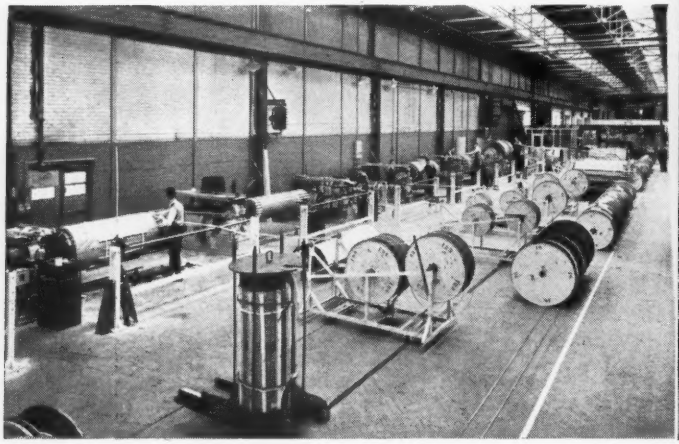
To allow for the despatch of the largest of transformers from the new bay, provision has been made for the entry into the building of road vehicles capable of carrying over 200 tons and the gates on to the main road are 40ft wide. The structure itself is clad and roofed with aluminium sheeting and it is probably one of the first of its size in the United Kingdom to be so treated. Since painting is unnecessary maintenance costs should be negligible.

Good natural lighting is achieved at working level during the daytime and, when required, a three-level lighting system (specially designed by the G.E.C. to the company's requirements) gives an unusually high intensity of artificial light over the whole floor area. The high level illumination comes from 1 kW mercury discharge lamps, the lighting source for the intermediate level being a combination of 250 W mercury lamps with 500 W tungsten lamps for colour correction. Additional colour correction coupled with auxiliary lighting in the vertical plane (especially important in this class of work) is provided by continuous trough fluorescent lighting at low level. To achieve a spacious and light appearance at all times, special attention has been given to the internal decoration, the walls being coloured dove grey, with an apple green dado and eau-de-nil main steel work.

The opening of this extension marks the completion by the company of a long term plan for the progressive modernization of its factory and by the end of the year the whole of the 200,000 sq ft of manufacturing space will have been reorganized on the most efficient lines. This has involved the moving of practically every department in order to secure the logical and most convenient production flow throughout the works.

On-load tap changer assembly shop

Coil winding department



Electricity's Contribution to Prosperity

The B.E.A. Report Debated by Parliament

IN the House of Commons on 9th November the Minister of Fuel and Power (Mr. Geoffrey Lloyd) moved that the House should take note of the latest annual reports and statements of accounts of the gas and electricity industries. He dwelt particularly on the contribution these industries could make to the doubling of the standard of living within a generation—the object lately set by the Chancellor of the Exchequer. In regard to electricity, he said that as a result of greater industrial activity, consumption had recently been 14 per cent higher than in the same period last year.

His policy was, first, to approve long-term extension plans and he quoted Lord Citrine's statement that capital authorization for generating plant was now substantial. Secondly, he wished to encourage active competition with gas and oil and he had restored freedom to advertise and to develop fully promotional and service activities. It was in the national interest that the Boards should be enterprising and indeed, venturesome, and he would defend any mistaken decisions that were soundly based.

Domestic Electrification

The contributions to raising living standards were threefold: internal efficiency (especially fuel economy); services in the home; and furthering the productivity of industry as a whole, as measured by the increase of consumption per factory worker. As an instance of desirable domestic electrification he cited the increase in the number of washing machines during the past five years from 300,000 to two million. A five-year plan for agriculture provided for an expenditure of £50 million to bring electricity to 70 per cent of farms and 80 per cent of rural houses. Last year the record number of 13,000 farms had been connected.

A new flexibility had been given to fuel supply by the decision to burn up to 10 million tons of oil at B.E.A. power stations on a coal-oil dual-firing system. On the eastern seaboard of the United States, where the electricity output was comparable with that in this country, coal requirements during the past six years would have gone up from 37 to 44 million tons but for the installation of dual-firing equipment in one-third of the thermal power stations. The coal equivalent of 7 million tons had been provided by oil.

The use of atomic energy, as far as could now be foreseen, would necessitate the connection of homes and factories to ordinary electricity supply systems. The problem was to control the rate of physical change in nuclear fission that produced the heat, without getting dangerous radiations. In present experimental atomic power stations the generating plant was separated from the nuclear furnace, from which the heat was transferred by a special substance, such as carbon dioxide. The man-made element plutonium enabled most of the uranium to be used as fuel instead of the 0·7 per cent of it that was naturally fissile. Two dominant factors in industry in the future might be nuclear energy and automatic electronic control of industrial machinery.

Mr. Alfred Robens criticized an estimate in the report of a lapse of ten years before a large nuclear power station would be feeding into the grid, which, he believed, would put this country behind the United States; if delay were due to lack of scientists and experts, requisite training must be provided. He also criticized the smallness of the amount spent on research, £243,000 per annum as compared with the expenditure on publicity of £968,000. Sir William Darling pointed to the immense amount of additional electrical research undertaken by private enterprise and expressed the view that the respective allocations were not remarkable.

Mr. A. M. F. Palmer pointed out that since vesting day the electricity industry had saved 12 million tons of coal and the gas industry 2 million tons. He supported the principle of free consumer choice and of advertising in the Press by publicly owned bodies. The inclusion of an engineer in the Herbert Committee on organization was to be commended. That committee might consider whether separation of generation and bulk transmission from distribution was essential.

Last year two-thirds of the total industrial investment of the country went to electricity and gas. The real average price of electricity per kWh in relation to cost of living to-day was about 40 per cent of the 1938 figure. This falling tendency went farther in the United Kingdom than elsewhere in Europe, but he doubted whether the price of peak kWh here was high enough.

Mr. G. Nabarro said that the re-opening of the Abadan refinery would make available 35 million tons of oil within three years of which 40 per cent would be the British share; this would match the increasing demand for fuel oil in power stations. More than half of the 285,000 farms had been connected to the mains, but every new connection would become progressively more expensive and the use of small auto-diesel units might be more economical in areas remote from the grid. There was a vital link between rural electrification and railway electrification in nuclear power. The difference between the 6 per cent thermal efficiency of steam locomotives using large coal and the present 24 per cent of power stations using low grade coal presented an irrefutable case for electrification of the more heavily loaded main lines. He suggested that within five to seven years the main line (158 miles) from London to Crewe should be fully electrified with transformation points along the routes to serve contiguous rural areas.

Expenditure on Research

The Parliamentary Secretary to the Minister of Fuel and Power (Mr. L. W. Joynson-Hicks), referring to complaints of the small amount allocated to research, drew attention to the statement in the report that this did not include the capital expenditure on or the revenue that accrued from works which formed part of the industry's normal productive capacity. The industry was also doing a very great deal in direct and indirect research through other agencies. Admitting that the phraseology of the report in this respect might well be clarified, he promised to endeavour to obtain a figure representing the total sum expended on research.

BOILER BREAKDOWNS

IN a paper presented before the Institution of Mechanical Engineers on 12th November, Mr. J. Eyers (Vulcan Boiler and General Insurance Co.) dealt with the inspection, explosion and breakdown of boilers and pressure vessels. Certification under the Factory Acts, he said, still rested on the basis of visual examination together with hammer and hydraulic tests, but such examination equipment as magnetic crack detectors, gamma and X-ray and ultrasonic apparatus was becoming of increasing importance. The last-named was at present of limited application but had already given practical results and would undoubtedly be developed and be more often used in the future. Low-water was the commonest cause of explosions and examples of these and of other origins of trouble were described in detail. Explosions were not as violent and as frequent as they were 75 years ago, chiefly owing to superior construction and materials, but there was still a similar neglect of fundamental principles and safety precautions. Too little care was taken to train operators. Efficient inspection was of little avail if subsequent staff supervision was lacking.

Large-Scale Electro-Precipitation

By D. O. HEINRICH, Dipl.Ing.*

Some Notes on the Theory and Practice

INTENSIVE testing of large electro-precipitators—mainly initiated by the British Electricity Authority, which is nowadays the biggest single user of electro-precipitation—has produced performance results differing distinctly from those of earlier laboratory tests and those predicted by "classic" theory. Some of these differences are discussed in this article, with special reference to test results on large-scale plants.

Calculations of the design and performance of electro-precipitators have been largely based on the classic equations developed by Deutsch[1] and others. The Deutsch equation for the efficiency of electro-precipitators is based on the assumption that the gas in the precipitator is in a state of complete turbulence and that all the particles in suspension are therefore thoroughly mixed: it is also assumed that the dust concentration is uniform over each cross-section but is progressively reduced from one cross-section to the next, each section of the total length of the precipitator removing an equal proportion of the remaining dust. The dust particles move towards the receiving electrodes with an average drift or migration velocity which, according to theory, is proportional to the particle size (for particles over about 2 microns diameter).

The resulting equation can be most generally expressed in the form:

(1)....$y = 1 - e^{-k}$ where y is the efficiency and k the exponent.

For the exponent k a number of expressions can be substituted, e.g.:

(2)....$k = wF$

(3)....$k = w\frac{L}{Dv}$

Here w (m/s) is the migration velocity, F ($m^2/m^3/s$) the specific receiving surface, D (m) the spacing between discharge and receiving electrodes in plate-type precipitators, L (m) the length of receiving electrode in direction of gas stream, and v (m/s) the gas velocity. While F (or any substitute) represents the geometry of the precipitator together with the gas velocity, w represents the average migration velocity of dust particles towards the receiving surface; w in itself combines theoretically known quantities and can be calculated from the equation:

(4)....$w = \frac{pE_1 E_c \rho}{6\pi\eta}$

Here E_1 (stat V/cm) is the field strength in the ionization zone, E_c (stat V/cm) is the field strength in the collecting zone, ρ (cm) the radius of particle, η (poise) the absolute viscosity, and $p = \frac{3\delta}{\delta + 2}$ where δ is the dielectric constant.

In single-stage electro-precipitators, i.e., those in which ionization and collection take place in the same zone, the field strengths E_1 and E_c are normally assumed to be equal, so that equation (4) becomes:

(5)....$w = \frac{pE^2\rho}{6\pi\eta}$

In such precipitators the field strength is generally calculated from the equation:

(6)....$E = \sqrt{\frac{2i}{b}}$ where i (stat A/cm) is the corona discharge current per unit length of discharge wire, and b (cm/s/stat V/cm) the mobility of ions.

Alternatively, for plate-type precipitators, according to Troost[2]:

(6a)....$E = \sqrt{\frac{4i}{b}}$

This is an abridged form of equation referring particularly to dust-free spaces: it has been shown by Pauthenier[3] and others that the effective field strength is considerably increased when dust is introduced into the space between the electrodes.

The following equations have been given in a paper by Lowe and Lucas[4]:

(7)....$E = \frac{1}{r}\left[\left(\frac{1}{bp^2S^2} + C_0^2\right)\exp(2pSr) - \frac{2i}{pSb}\left(r + \frac{1}{2pS}\right)\right]^{\frac{1}{2}}$

(8)....$E = \left[\frac{2i}{b}\left(1 + \frac{2}{3}pSr\right) + \frac{C_0}{r^2}\right]^{\frac{1}{2}}$

(9)....$E = \left[\frac{2i}{b}\left(1 + \frac{1}{3}pSr\right)\right]^{\frac{1}{2}}$

Here r (cm) is the distance of the point in question from the axis of the cylindrical electrode, S (cm^{-1}) the total surface area of dust per cm^3 of flue gas, and C_0 the constant of integration.

The above equations could possibly be reduced to the simple equation (6) by assuming that the space charges considerably reduce the effective average mobility of ions b, which is responsible for the transportation of charges and therefore for the current. If the reduced mobility b′ were known for given conditions, the equation $E' = \sqrt{\frac{2i}{b'}}$ would give results of more practical value than equation (6).

In the abridged equations (8) and (9) the term $\frac{2i}{b}$ appears again explicitly, and according to these two equations and equation (6) the field strength should be proportional to the current input. Combining these with equation (5) would give:

(10)....$w \propto i$

In laboratories[5, 6] and in semi-field tests[7] it has been found that precipitator efficiency does follow an exponential law. In some tests[5, 6] the results agreed with the efficiencies calculated from the classic equations (1), (5) and (6), and in particular the expected relation between efficiency and particle size was found to hold good. The conclusions arrived at from classic theory and equations

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will now be discussed in the light of more recent findings, with particular regard to the performance of large-scale precipitators.

Turbulent and Laminar Gas Flow

It has on occasions been doubted whether turbulent gas flow exists in an electro-precipitator to such an extent as to affect its performance. Pauthenier and co-workers[8] recently photographed the trajectories of particles moving in an ionizing field: the photographs showed that the particles followed a straight path towards the receiving electrodes, and no indication of turbulence could be observed.

While this may hold good for observable, i.e., comparatively large, particles, all available information indicates that the bulk of the particles, that is, the overall performance of the precipitator, follow the exponential law of dust removal. It is generally accepted that this indicates turbulent flow behaviour of the particles. Lowe and Lucas[4] expressed the opinion that laminar flow behaviour is possible with the larger particles observable in such tests as those of Pauthenier, but that turbulent flow behaviour is most likely with the smaller particles.

Moreover, an exponential law of dust removal, even under laminar gas flow conditions, could be arrived at by assuming that a certain more or less constant amount of deposited dust is re-entrained. Assume that, say, 90 per cent of the dust is precipitated on a 1ft length of receiving electrode and that 50 per cent of this quantity is re-entrained; assume further that 90 per cent of this re-entrained dust is precipitated on the second 1ft length of electrode and that 50 per cent of this quantity is again re-entrained: under these conditions it can be seen that dust removal would follow an exponential law, approaching asymptotically the limit of 100 per cent removal. If laminar gas flow did prevail and the above process did not occur, precipitation would follow a linear law of the form:

$$(11) \ldots . y = wF$$

With a given specific collecting surface, particles migrating towards the receiving electrodes above a certain velocity would be precipitated with 100 per cent efficiency, and if this were actually the case precipitators could be greatly reduced in size. For instance, a precipitator operating with an average migration velocity of 10 cm/sec and giving 95 per cent efficiency would require a specific collecting surface of 30 m^2/m^3/sec according to Deutsch's exponential law, whereas under the linear law the surface required would be only 9·5 m^2/m^3/sec. It is, however, well known that in large-scale precipitators designed on the basis of exponential law there is little difference between the theoretical efficiency and the efficiency obtained in practice. There can therefore be no question of reducing precipitator size on the basis of a linear law.

Efficiency in Relation to Particle Size

Classic theory indicates that dust removal efficiency should increase with particle size. Relating this to migration velocity, a linear relation between migration velocity and particle size should exist, as indicated in equation (4). As can be seen in this instance, reference to migration velocity rather than efficiency results in the easily comprehensible relation of linearity.

Some figures have been given[9] which indicate that efficiency is lower for particles above about 76 microns than for smaller particles. In certain tests, using electrodes other than plane plates, which were carried out by the author, however, it was found that no drop in efficiency took place with larger particles, but that these particles were not precipitated at a rate suggested by theory. In these tests, in order to obtain a sufficiently large sample of outlet dust, the overall efficiency was reduced by operating only a quarter of the precipitator: the fractional efficiencies at the reduced overall efficiency were: Above 40 microns, 96·5 per cent; 40–20 microns, 92·4 per cent; 20–10 microns, 92·6 per cent; 10–5 microns, 92·35 per cent; and below 5 microns, 80 per cent. These figures are typical of a number of similar results.

To explain the discrepancy between theory and practice, Lowe and Lucas[4] considered what happens when a particle has been removed from the gas stream and precipitated on an electrode surface. In estimating the adhesive forces holding a particle to a plate electrode and the acceleration required to dislodge it, it is found that large particles are much more readily dislodged and therefore more subject to re-entrainment; the effect is pronounced with large conductive particles, which are repelled back into the gas stream by the change in polarity which occurs when the particle touches the electrode. This qualitative consideration appears to lead to a closer approximation of actual precipitator performance.

It should be mentioned that for design purposes and for better comparison between different tests it is advantageous to reduce fractional efficiencies to fractional migration velocities. This was done for the figures given above, and a qualitative curve is given in Fig. 1. The straight theoretical curve in this graph is calculated on the basis of Troost's expression (6a) for field strength in plate-type precipitators.

It can be seen that the test results obtained show very small particles to be precipitated at a higher rate than that suggested by theory. Particles above about 10 microns are all precipitated at an even rate. With the type of collecting electrode used there is no drop in the rate of precipitation for large particles but a slight increase above the rate of the intermediate range.

Rapping of Receiving Electrodes

Consideration of the forces acting on particles adhering to receiving electrodes led Lowe and Lucas to the conclusion that electrodes should be rapped as gently and infrequently as possible consistent with efficient particle removal. The best results would obviously be secured if no rapping were necessary, as in liquid-flushed and mist precipitators, but when collecting dry dust the "no-rapping" condition can only be simulated by closing sections of the precipitator during rapping.

In order to evaluate the optimum results obtainable, tests were carried out in which no rapping was simulated by discontinuing the sampling of outlet gases during rapping periods and for a certain time thereafter. With the particular type of high-duty electrode used the following results were obtained:

Slow rapping	98·0 per cent efficiency
No rapping	98·8 „ „ „

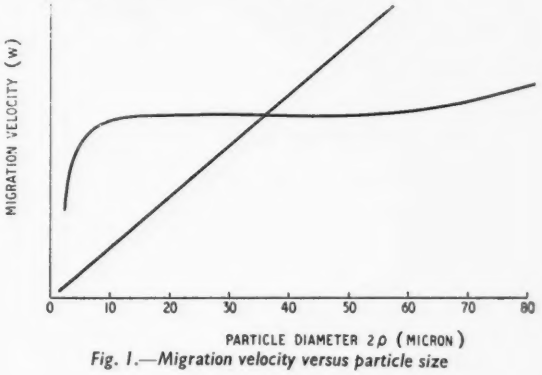

Fig. 1.—Migration velocity versus particle size

Reducing these figures to migration velocity and thereby to precipitator size, it is found that the increase in migration velocity amounts to about 12 per cent. This compares with figures quoted by Troost:

Rapping	.. ..	90·0 per cent efficiency
No rapping	.. ..	95·7 „ „ „

The corresponding increase in migration velocity is more than 35 per cent.

Let us now consider whether anything would be gained by closing part of the precipitator during rapping in order to take advantage of the somewhat higher efficiency which prevails under no-rapping conditions. For this purpose it is assumed that the precipitator is subdivided into four separate compartments, and that to close, rap and open each compartment takes 5 minutes in every hour: it follows from this assumption that for 20 minutes in every hour the gas velocity through three of the four compartments is increased by one-third.

On the basis of the test results quoted above, a precipitator of 99 per cent efficiency could be built about 12 per cent smaller for simulated no-rapping operation than a precipitator with normal rapping. Its efficiency, however, would fall to about 96·9 per cent during rapping periods owing to the higher gas velocity through three of its four compartments, and redistribution of the dust loss over a period of one hour would result in an average efficiency of about 98·3 per cent: to restore the efficiency to the required 99 per cent would require a 15 per cent increase in size. It is therefore clear that no advantage would accrue from closing sections of the precipitator during rapping periods. This expedient would only be justified (*a*) at higher rates of particle re-entrainment during rapping, (*b*) with more extensive sectionalization of the precipitator, which is costly in itself, or (*c*) when using rapping intervals of the order of hours: even then it would need close investigation to ascertain whether the capital and operating costs of the precipitator would be reduced.

Rapping is not quite so critical a factor when well-designed electrodes are used. With a particular type of high-duty electrode in a precipitator working at 95 per cent efficiency, no increase of efficiency was observed when the rapping interval was lengthened from one blow per minute to one blow per seven minutes.

With such high-duty electrodes the force of the rapping blow has little effect on the efficiency of the precipitator, and the blow can therefore be strong enough to ensure effective cleaning of the electrodes. This has not always been achieved in the past, and some loss of efficiency has resulted over a period of time: that this loss is not inevitable in properly designed plants is evidenced by the fact that there are precipitators still in efficient operation after twenty-five years.

Efficiency and Current Input

Theory, as expressed in equation (10), suggests that migration velocity is proportional to current input. In a recent publication[10] the following test results were given (see Fig. 2):

Primary V	Primary A	Efficiency %	Exponent k
360	1·67	79·3	1·55
400	5·5	91·4	2·45
470	14·5	96·5	3·35

Although these figures are primary values, the current is normally transformed by a constant ratio and can therefore be interpreted as secondary current. According to theory, there should be agreement between the ratios of currents and the ratios of the exponent k (which is proportional to migration velocity), but the following figures show that no such agreement was found, as the ratios of currents were 1 : 3·33 : 8·7, and the ratios of exponent k 1 : 1·58 : 2·16.

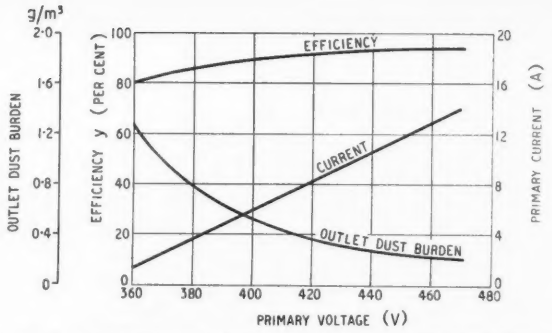

Fig. 2.—Precipitation efficiency versus primary current and voltage

Walker and Coolidge[11] stated that in their tests on a small laboratory precipitator they found the relation:

(12)....$y = 1 - e^{-c(V-V_c)}$ where c is a constant, V the applied voltage, and V_c the corona starting voltage. The corona starting voltage for the published test results is not known, but it is easily possible to evaluate a suitable figure for V_c, which comes out as 270 V. The ratios of exponents and the ratios of $V-V_c$ then agree closely, the respective figures being 1 : 1·58 : 2·16, and 1 : 1·45 : 2·22. The ionic current, however, should also follow the equations:

(13)....$i = \frac{2b}{R^2 \ln \frac{R}{a}} V(V - V_c)$

(14)....$i = c' V(V - V_c)$

Here R (cm) is the radius of the collecting tube, a (cm) the radius of the discharge wire, and c′ is a constant. Suitable evaluation of V_c for this equation gives a figure of 340 V as compared with that of 270 V found previously. All the indications are that the relations so far suggested between efficiency and current input do not agree with results obtained in practice, and that further work in this field would be of interest.

Conclusions

Comparison of actual electro-precipitator performance with the results predicted by classic theory shows that an exponential law of dust removal holds good in general: there is no question of linearity, which would be found if laminar gas flow were predominant. Theory requires amendment where it predicts fractional migration velocities. Secondary effects of re-entrainment prevent large particles from being precipitated at theoretical rates. Rate of rapping and correct design of receiving electrodes have an important influence on the efficiency of precipitation. Further study is required to establish a relation between current input and efficiency.

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MAIN LINE ELECTRIFICATION

Progress of the French Railways

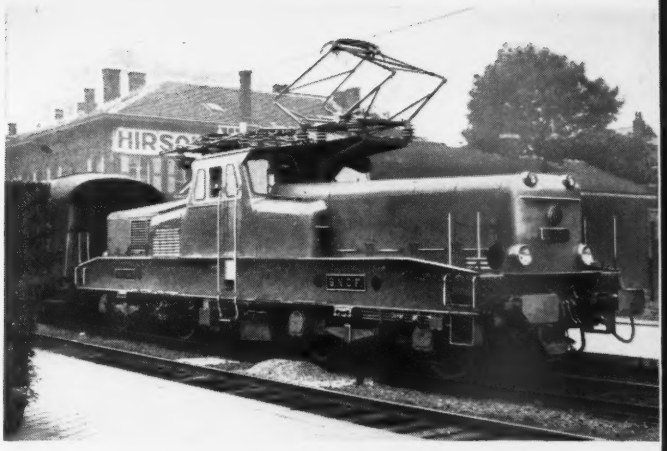
THE French Railways have already electrified 2,800 miles of line, in particular the main lines between Paris and Lyons, Paris and Hendaye, Paris-Toulouse and Nîmes, Paris and Le Mans, which carry 30 per cent of its total traffic. In the north and east of France they are now proceeding to electrify the main line from Lille to Thionville, Metz, Strasbourg and Bâle, which carries the heaviest freight traffic of any line on the French Railways. This is mainly composed of complete train loads of iron ore from Lorraine, of coal and coke, and of limestone.

Up to now the French Railways have adopted 750 V or 1,500 V d.c. for electric traction, with excellent results. However, this type of electrification involves heavy capital expenditure for the conversion and distribution of current from the grid to the locomotive.

As a result of work carried out since the war, the French Railways have perfected a system using 25 kV 50 c/s single-phase a.c. This makes it possible to reduce appreciably the equipment necessary for the supply of power to the traction motors of the locomotive and consequently to achieve a considerable economy in capital expenditure. The amount of electrification which can be carried out with the capital which is available is thereby increased. In addition, this type of electrification pays for itself in a shorter period.

Trials on lines in the region of Annecy in Upper Savoy since 1950 proved so conclusive that the French Railways decided to adopt h.v. a.c. electrification in the north and east of France. Substantial economies in expenditure on high-voltage lines, substations and contact lines are thus being achieved. The nature of the traffic in this industrial region involves the haulage over lines with numerous gradients of train loads of freight far heavier than anything handled elsewhere on the French Railways. This has led to the construction of locomotives which, for the same weight, can haul much heavier loads than other types.

Three prototypes of a series of 160 locomotives have now been put into service on the 109-mile Valenciennes–Charleville section which has many gradients, several with long stretches of 1 in 100. The first two in service both weigh 80 metric tons and are BB mixed traffic locomotives for passenger, parcels and ordinary goods trains, built by the Société le Matériel de Traction Electrique (Schneider, Jeumont) but differing one from the other in the electrical equipment. One of them, BB 13001, is equipped with single-phase Jeumont traction motors, and is the first of a series of 24 now under construction. It has already covered 19,871 miles hauling trains of an average weight of 685 metric tons, but which frequently attained as much as 900 tons, thereby exceeding their calculated performance when designed.

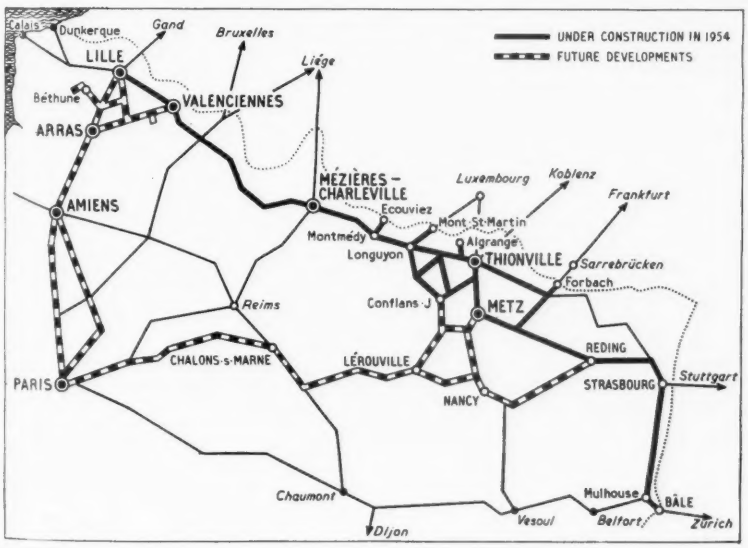


Locomotive BB 12001 for the Valenciennes–Thionville electrification

The other locomotive, BB 12001, is equipped with "Ignitron" mercury vapour rectifiers and series-wound undulating current traction motors, and is the first of a series of 14 under construction. It has covered 17,833 miles hauling trains of an average weight of 675 metric tons, but which frequently attained or exceeded 1,000 metric tons. It has even been found possible to start easily trains of 1,200 metric tons on a rising gradient with this locomotive, a performance almost impossible with other types of traction of similar weight.

The third locomotive, CC 14101, weighs 120 metric tons and is designed to haul very heavy goods trains which are an essential feature of traffic on this line. It is the first of 102 being built by the Société Alsthom. It has so far covered 13,390 miles hauling trains of an average weight of 1,380 metric tons, but which frequently attained 1,800 metric tons. Numerous starting tests on rising gradients have demonstrated that the capabilities of this locomotive for hauling very heavy goods trains exceed anything previously achieved in this respect on the French Railways.

More locomotives identical with these prototypes are now being received from the builders, and deliveries will be accelerated to a rate of seven or eight a month by the beginning of 1955. A further series of 20 goods locomotives of a different type but from which much is hoped are now being built by the Société Oerlikon and deliveries are expected to commence early next year.



Electrification in the north and east of France at 25 kV 50 c/s single-phase a.c.

Calcium Carbide Production

IN a paper presented yesterday before the Utilization Section of the Institution of Electrical Engineers, Mr. C. J. Beavis (The Distillers Co.) dealt with the use of electricity in the production of calcium carbide in a typical modern works. The process, he stated, was essentially a smelting operation in which calcium oxide reacted with carbon to produce an 80 per cent carbide-lime solution with a net gas yield of 4·8 cu ft/lb.

The temperature required lay between 1,600 and 2,500 deg C, which was produced in three-phase arc furnaces, in which the arc was submerged in the charge. These furnaces formed over 95 per cent of the electrical load and their electricity consumption per ton was between 3,000 and 3,500 kWh with an annual load factor of 75 per cent. Power factor was maintained at 85 to 88 per cent.

The furnace with its low-voltage busbar, transformer (with under 2 per cent reactance) and electrode assembly was equivalent to a circuit containing constant reactance and its charge provided a variable resistance.

Every ton of carbide required two tons of clean graded limestone, which was fired in a rotary kiln (7 tons/hr) with pulverized bituminous coal (80 per cent through a 200 mesh screen). The lime was pre-heated to 500 deg C by kiln gases as they travelled to an induced-draught fan. The temperature in the burning zone was between 1,300 and 1,400 deg C. When cold particles below 18in (the same minimum size as for the coke) were screened off the remainder was elevated to storage by a hoist fitted with electronic control which ensured that it operated only when the bucket was filled to a predetermined level.

Soderberg self-baking electrodes, made of carbon paste prepared from calcined anthracite (80 per cent) and a bond of tar-pitch mixture (20 per cent) were used. Resistivity of the anthracite was reduced by driving off volatiles in an electrically heated calcining furnace, one electrode being suspended at the top and the other at the bottom. These electrodes were supplied from a 500 kVA 11 kV/75 V core type transformer (4 per cent reactance) in open delta on both sides with eight off-load taps down to 55 V. When the current rose to between 4,000 and 4,500 A calcining was complete.

The carbide furnace consisted of a six-sided refractory-lined steel bowl, in the bottom of which at the start of its life was placed a 5ft bed of anthracite, ¼in down to dust. (Constructional details were given in the paper.) Power was derived from three 10,120 kVA 33 kV/220 V delta/delta shell-type transformers with a reactance of 1·7 per cent. Load on the furnace was changed by voltage variation. The purpose of electrode movement was to compensate for carbon consumption and to maintain a balance between the three furnace transformers.

Electricity was supplied to the works from the grid at 33 kV through two 45 MVA transformers. A 700 kV 400 V diesel alternator was installed to keep essential services going in emergencies, but it did not run in parallel with the main supply. All electric motors were of the totally enclosed fan-cooled type, plain squirrel-cage machines being used whenever starting conditions permitted.

I.O.W. Television Transmitter

THE new B.B.C. television (vision and sound) transmitting station at Rowridge, Isle of Wight, was inaugurated last week.

The station is designed to operate on Channel 3; vision 56·75 Mc/s and sound 53·25 Mc/s.

It is the first of the five medium-power stations to be equipped with permanent transmitters, and part of the B.B.C.'s 18-station plan to provide a television service for 97 per cent of the population of the United Kingdom.

The main vision transmitter, which was manufactured by Marconi's Wireless Telegraph Co., Ltd., is of the low-level modulated type with a peak white output of 5 kW. Modulation is carried out at the 500 W level and the signals are then amplified by two class "B" wide-band linear r.f. amplifiers each using a pair of forced-air-cooled triodes, type BR 191, made by the English Electric Co., Ltd. The appropriate shaping of the vestigial side-band signals radiated by the vision transmitter is carried out entirely by its own tuned circuits and not by a separate vestigial side-band filter. The valve filaments are a.c. heated, with the exception of those in the modulated amplifier and the linear amplifiers, which are supplied from metal rectifiers. The transmitter h.t. supplies are obtained from hot-cathode mercury-vapour rectifiers, which provide a maximum of 3,000 V for the anodes of the linear class "B" amplifier stages.

The sound transmitter, also manufactured by Marconi's, is of the conventional class "B" modulated type and is rated at 2 kW output. The output power will be adjusted to 1·25 kW to maintain the standard ratio of 4 : 1 in terms of vision to sound power. All valve filaments are a.c. heated. As in the case of the vision transmitter, the crystal-controlled drive and the power-conversion equipment are built as an integral part of the transmitter. Both transmitters are contained in similar sheet steel cubicles mounted side by side and so present a single continuous front in the transmitter hall.

A 32 kVA 240 V 50 c/s single-phase diesel-alternator set is provided as stand-by in the event of mains failure. It is arranged to start up automatically, should the public supply fail, when it would provide power for the vision and sound input equipment, the low-power stand-by vision and sound transmitters and certain essential lighting.

The area to be served by this new station when it is equipped with its permanent aerial and mast next autumn (at present a temporary aerial and mast are used) will embrace the whole of Hampshire and parts of Dorset, Wiltshire and West Sussex, serving some 2,600,000 people.

Public Transport Association

THE delay in the denationalization of the road passenger transport industry and the crippling effect of the fuel tax were two of the points made by Mr. E. L. Taylor, chairman of the Public Transport Association, at the Association's annual dinner held on 11th November at Grosvenor House, London.

Mr. Taylor, who was replying to the toast of the Association proposed by Lord Hawke, said that while the public transport industry represented only a part of the responsibilities of the Minister of Transport and Civil Aviation, it claimed that it was the most public of the transport services, catering as it did for the man in the street. It was disappointed in the delay in the application of the 1953 Act which it hoped would effect denationalization, particularly as the Act had been applied to road haulage. The thought behind the Act was clearly to restore the situation in being up to 1948 when there were three large groups of companies operating outside London, the bulk of whose shares were owned in equal partnership between free enterprise and the railways, but with the British Transport Commission taking the part of the former railway companies. He hoped that no further time would be lost in putting the plan into operation.

Referring to the fuel tax Mr. Naylor said that it represented something like 250 per cent of the basic price of the commodity, or in terms of operation, 3d or more for every bus mile run. Unless some relief was forthcoming soon, the services must inevitably suffer. He also hoped that the industry would be allowed to have double-deck buses 30ft long on two axles instead of the three axles required by the regulations.

The toast of the guests was proposed by Mr. Winston Robinson, a member of the Council of the Association, and Lord Brabazon, who replied, was in his usual good form.

INDUSTRY AND THE HOUSE

Electricity and Gas Reports Discussed

By A. M. F. PALMER, A.M.I.E.E., M.P.

A FEATURE of the House of Commons in the present Parliament is that the close balance in numerical strength of the Conservative and Labour parties means Members have to be often in close attendance for fear of the unexpected division. Hence on the days when it is certain there will be no division Members, if not directly interested in the subject under discussion, tend to stay away from Westminster in perhaps fairer fields. It was thus with the debate on the annual reports of the nationalized electricity and gas industries. Throughout, from early afternoon to the winding up speeches—a little before 9 o'clock—there was only a thin sprinkling of Members on the green benches. Labour Members—as is appropriate for the nationalizing party—were in greater concentration, but neither party could claim overwhelming outward parliamentary interest in the working out of nationalization.

Maybe, of course, the thin attendance was an unintended tribute to the unobtrusive, everyday efficiency of the electricity and gas boards now that the controversies of vesting days are behind us and national ownership is accepted as something which has come to stay. Indeed last Tuesday's experience might be thought by some to strengthen the case for a Select Committee which would give detailed parliamentary attention to the annual reports of nationalized industries. It could be argued that a group of Members specifically charged with the duty of investigation would be more successful in scrutiny than Members participating in a general debate.

Competition to be Encouraged

The Minister of Fuel and Power, Mr. Geoffrey Lloyd, in an enthusiastic speech, provided what will be regarded by electrical people as excellent news on a matter of major policy. The Government had decided positively to encourage the nationalized gas and electricity industries to compete actively with each other and with oil. This, he thought, would help the boards to conduct their business with enterprise and "a spirit of adventure." He recognized that not every venture could be successful and mistakes were bound to be made. He assured the House, however—to the applause of the Opposition—that when decisions had been taken on sound grounds, he would regard it as his duty afterwards to defend the boards.

Mr. Lloyd said that the Government's fuel policy was not only to get more coal but to use it better, supplementing with other fuels as was necessary to support an expansionist policy of increased productivity. To put at rest the doubts of those who have wondered if the B.E.A. is really in on the ground floor in nuclear energy development, he mentioned that in his discussions with electrical engineers he had been struck by the practical way in which they were setting about their work in this new field. The B.E.A. was collaborating closely with the new Atomic Energy Authority and plant manufacturers in the design of nuclear power stations.

As is perhaps inevitable these days, the greater part of the Minister's speech was given over to electricity, but he had a kind word for gas. Onlookers, he said, had often prophesied the end of the gas industry, but they had been wrong. That industry, with official encouragement, was hard at work on several new lines, including research into the use of cheaper coals. A new process of making gas from fuel oil alone had been found; sixteen new plants were being installed. He referred also to the much publicized search for natural gas in Britain and arrangements to be made for the import of liquid methane. Then Mr. Lloyd's imagination soared away. He told of the automatic factory of the future with its machines linked in series and controlled at the centre by an electronic brain. Nobody bothered to ask if such brains had any possible application in political life!

Mr. Alfred Robens, former Parliamentary Secretary to the Ministry of Fuel and Power, was the first speaker from the Labour side. He took up a theme repeated several times later in the debate; he asked if sufficient money was being spent on research in the electricity and gas industries? He thought that more money should be spent on research and less on the wrong kind of publicity. Turning to the bench behind him, with a dramatic gesture, he dumped on to the despatch box a weighty armful of the reports from the B.E.A., the Gas Council and their area boards, and demanded to know if it was seriously supposed that Members even in their most conscientious mood could digest such a mass of material? Was it not possible for effective summaries to be provided?

Mr. Nabarro allowed his rich fancy to roam up and down several technical or near-technical by-paths. These included the electrification of the railway line from London to Crewe, combined with the provision of electricity at intervals for rural electrification "adjacent and contiguous" to the track. He criticized vigorously the B.E.A. for its alleged neglect of district heating schemes and contrasted British lack of progress with the work done by the Germans in Hamburg. The B.E.A.'s record was a "sad story of lost opportunities for a massive contribution to fuel efficiency."

Rural and Urban Viewpoints

Other speakers concentrated upon local rather than national matters with a decided "constituency" flavour in their speeches. Among them were Mr. George Lambert, who sits for Torrington as a Conservative, and Mr. Wilkins, the Labour Member for Bristol South. Mr. Lambert speaks for a rural interest in the area of the South Western Electricity Board; Mr. Wilkins for a strong urban and industrial interest. Although the former paid full tribute to the enterprise of the South Western Electricity Board in rural electrification, he still felt that costs could be cut if, for instance, publicity work in the obtaining of new consumers was reduced. He thought that advertisements in local newspapers would be just as effective as bands of canvassers descending in cars on villages. Mr. Wilkins, however, expressed himself as "rather dismayed" at the lack of gratitude shown by Torrington's Member. After all, rural Devon and Cornwall should not complain; it

was the gallant consumers of Bristol who had borne the burden of increased charges in order to assist their needy country cousins. If a Wilkins could take it smiling, why not a Lambert?

Pricing policy was given surprisingly little attention throughout the debate, but Mr. Richard Fort, a Conservative who sits for Clitheroe, alleged there was a large element of subsidy in present charges for domestic electricity for which industry was paying. Mr. Cyril Bence, Labour Member for Dumbartonshire East, thought that the whole system of cost accounting and financing in the nationalized industries should be examined. It was nonsensical that publicly-owned industries should be obliged to pile up burdens of debt.

In an excellent debating speech, Mr. Michael Stewart, a former Labour junior Minister, said that the facts in the reports before the House showed that all the old hackneyed arguments generally advanced against public ownership had been knocked down. In a technical age with great sums of capital needed for investment, unless the community itself took these matters in hand it was unlikely that they would be done at all.

The winding up speech for the Opposition was made by the writer; he would prefer to leave that to the columns of Hansard, and instead to record Mr. Joynson-Hicks, the Parliamentary Secretary to the Ministry of Fuel and Power, as saying he could assure the House that the Government held most strongly the view that the need to be first in atomic development was a matter of national prestige. Unfortunately he was not able to answer, as yet, a question about the division of national capital expenditure as between nuclear power stations and new coal mines.

Borehole Measurement

OPENING a discussion on measurements of boreholes at the Institution of Electrical Engineers, Measurements Section, Mr. P. Threadgold described the numerous electrical instruments required. A borehole, he said, might be two miles deep; temperatures might exceed 200 deg F, and hydrostatic pressures might reach 15,000 lb/ sq in.

Instruments to measure borehole inclination used the vertical and the magnetic north as reference directions; displacements therefrom were registered as a change of inductance or of capacitance and transmitted to the surface electrically. Diameters were ascertained by lowering a mechanical internal calliper, readings being converted to electrical quantities and passed up by cable.

Fluid pressures were measured by a Bourdon-tube element in conjunction with a clockwork recorder, a method which had not so far been superseded by electrical devices. The maximum-type thermometer sufficed for most fluid temperature measurements, but for a continuous log with depth, the electrical resistance bridge type was used.

Geological information was deduced from random radioactivity, measured by a Geiger-Müller counter with integrating circuits. The nature and extent of the fluid content of strata were calculated from the electrical resistivity of the whole formation.

Interaction between the borehole fluid and any water in the formation set up, electrochemically, a measurable d.c. potential, from which the resistivity of the water could be calculated. The resistivity of the zone invaded by drilling mud was evaluated by microresistivity measurements, using electrodes about one inch apart, in contact with the borehole wall but guarded from the fluid. Rapid geological observations at successive depths were claimed for a continuously operating geophone employing magnetostrictive effect.

Uranium Prospecting

In the subsequent discussion it was stated that in uranium prospecting, gamma-ray logging was usual in the shallower and smaller boreholes, the probe being passed down inside the drill. The use of transistors and cold-cathode valves obviated a power core in the cable.

Reference was made to an experimental scheme using a fast neutron source and logging the resultant slow neutrons from the formation, and an alternative means of registration by segregating the neutron-induced gamma-ray emissions according to their energy levels. The resistance of rock could be too high to permit of its use as an earth return for counting circuits. For deep boreholes, a single-core cable with an armoured conducting exterior was suitable.

In geothermal investigations temperatures of 450 deg F in a turbulent and corrosive mixture of liquids and solids were measured by a 2in diameter bathythermograph comprising a bi-metal element recording on a smoked slide. Thermocouple methods were precluded by lack of cable of sufficient strength or length. Subsequently, the opening speaker suggested the possibility of making scanning measurements to a diameter of 40ft with supersonic callipers.

An experimental velocity method of investigation used a piezo-electrical transmitter and receiver at either end of a 5ft probe and measured the time for transmission of a pulse. An electrically-driven percussive system had two receivers 10ft apart; their output was registered on a continuously-photographed cathode-ray tube.

Electrification of N.S.W. Railways

From Our Sydney Correspondent

ROUGHLY a third of the nine million inhabitants of Australia live in and around Sydney and at Newcastle. To improve transport services in that area an important railway electrification scheme is now in progress over a route of about 150 miles between Sydney and Lithgow, which will make the Blue Mountains area, Penrith, Blacktown, etc., suburbs of Sydney and available for housing city workers. After that Newcastle will be similarly linked up. The western scheme is well on its way to completion.

The electrification of the line as far as Lithgow will cost £6,000,000. It is being carried out in stages and the first section, to Blacktown, will be operating in January. By June, 1955, the line to Penrith will be all-electric and April, 1956, will see the inclusion of Katoomba and intervening stations. By 1957 the first electric train will be running to Lithgow. British Insulated Callender's Construction Co., Ltd., has the contract for the construction of overhead supports and cable work. The contractors use special rail cars for each process—first a " concrete car " which pours the foundations into square holes dug at the side of the line, and then a " steel car " which comes along with two cranes to lift the structure into place. Finally comes the " cable car " bearing copper cables.

Electricity Supply Engineers' Salaries

AT a meeting held in London on Tuesday, the National Joint Board for the Electricity Supply Industry approved a revised salary structure for application to certain members on the technical engineering staff of the industry. The revised structure provides for increased salaries for approximately 1,500 employees governed by the N.J.B. agreement and is operative from 1st July last.

VIEWS on the NEWS

By REFLECTOR

THE Commons debate on the B.E.A. annual report was notable for unanimity of the political parties in regard to the need for more and more electrification. The main difference between them appeared to be in claims to the greater credit for the success of the " nationally integrated " organization. Even the most serious criticism (which seems to have been due to a misapprehension) concerning the apparent meagreness of the expenditure on research was of happy augury; so was the seeming acceptance, almost as a matter of course, of the high priority given by the Minister of Fuel and Power to domestic electrification. Of most importance perhaps to the progress of the industry was Mr. Geoffrey Lloyd's exhortation to the B.E.A. and Area Boards to be " enterprising and indeed venturesome " in their activities—an exhortation that was backed by his promise to defend them if on that account the results of their efforts were not always entirely successful.

* * *

The shortage of technologists and the consequent endeavours of industrial concerns to attract such men to their service are reflected in an advertisement which appeared in *The Times* last week. This was from a company well known to the electrical industry and is worth quoting:—

> " A mixture of fun and frustration at satisfying salaries is offered to young metallurgists with sound fundamental training and some experience in industry. Opportunity will be provided to any interested applicant to examine scope and prospects as fully as he wishes at no cost to himself."

* * *

I had the occasion recently to stay at one of the few remaining large hotels still generating their own electricity supplies. As the voltage was only 110 V and my shaver was not of the dual-voltage type, I took rather a poor view of the situation. On inquiry, however, I was pleased to learn that for the benefit of people like me a special point providing 230 V was available in the hairdressing saloon. My spirits were, however, again damped when I discovered on my second visit to the saloon (it was late opening) that the socket was not, as one might have anticipated, a b.c. lamp socket, but a 5 A 3-pin unit. I should be interested to know what proportion of shaver users could have taken advantage of this. Anyhow it speaks well for the reserve capacity of my shaver that, using the 110 V supply, I was able to get a shave almost if not quite up to standard, though of course it took me rather a long time.

* * *

In the old days of electricity supply it was customary for the suppliers to require a deposit from would-be consumers as a safeguard against defaults in payment. Although interest was paid (at 4 per cent per annum) nobody liked the idea and it is now unusual for deposits to be demanded and I believe most of the Electricity Boards have refunded those which were outstanding when they took over. I was, therefore, a little surprised to see it reported that the judge at Rawtenstall (Lancs.) suggested that the North Western Electricity Board should revert to the custom of requiring a deposit from its consumers. The point arose from two cases brought against consumers for failing to pay their accounts. Such cases are comparatively rare; there is always the penalty of cutting-off the supply—the threat of which is usually sufficient to bring in the money owed. I do not think that the re-introduction of the deposit system would really be a good thing and I am sure the Electricity Boards agree.

* * *

In many parts of the country elaborate wire cradles have been slung beneath high-voltage lines where they cross G.P.O. telephone and telegraph wires. Their erection must have added a great deal to the cost of the h.v. lines, but if a suggestion by the Watford Town Council were adopted underground cables might become a cheaper way of transmitting power. Because a local schoolboy was badly burned after throwing a wire across an overhead line the Council (says the *West Herts Post*) is asking the British Electricity Authority " to consider providing protective equipment to overhead cables generally in the Borough."

* * *

Fish continue to involve themselves in electrical affairs. The latest instance is reported from Carmarthen Bay where, it is said, the warm water effluent from the power station has attracted so many salmon bass that no bait is needed to catch them. The statement was made by Cdr. T. A. Gibson, clerk and chief fishery officer to the South Wales Sea Fisheries Pollution Prevention Committee. But anglers may object as much to fish that practically give themselves up as fish killed or harmed by pollution.

* * *

Seventy years ago (15th November, 1884) the subject of the *Electrical Review's* leading article was " Electric Lighting for Steamships." It was based on a paper by Principal Jamieson read before the Institution of Civil Engineers. It was said that although it was not more than three years earlier that incandescent lighting had first been applied to the general illumination of ships, already more than 150 ships had been equipped with it. It seems that there was great difficulty in governing the speed of the steam engines driving the dynamos. This had to be done by hand apparently as there was no mechanical governor available to keep speed variation within a 5 per cent limit when the load varied by as much as 90 per cent. The author had heard of a case in which 50 of the 200 Swan lamps on board a large passenger steamer were suddenly broken through a failure of the governor. Another problem was the insulation resistance of circuits to which, Principal Jamieson said, too little attention was given by " electric light engineers."

Traction Motor Maintenance

Discussion on I.E.E. Paper

OPENING the discussion of the paper by Mr. J. G. Bruce on the overhaul and maintenance of d.c. traction motors, which was summarized in last week's issue, at the Institution of Electrical Engineers on 11th November, Mr. A. W. Manser (London Transport) claimed that while their traction motors ran only 50,000 to 55,000 miles a year the severity of the Tube service greatly exceeded that of any other in the country. Traction control equipments operated 900 times a day, and the brake equipment about 2,500 times. He considered that vacuum impregnation was useless. Many armature breakdowns resulted from carbonization of the insulation, but some silicone materials had an elasticity which prevented expansion and contraction of the bars, as well as overheating.

Mr. H. H. C. Barton (Merz & McLellan) pointed out that to-day there were still only 16 armature winders at the Acton Works, the same as in 1939, although the number of traction motors must have doubled. When the motors were run on the electrical test the resistances used were cooking other armatures in an oven.

Mr. H. Newsam (Metropolitan-Vickers) said that only through service experience could designs be improved. The motor overhaul period usually fitted in with the tyre-turning period, but with the new lathes which could turn the tyres while the coach was fully assembled the traction motor could probably be in the vehicle for much longer periods between overhauls. Roller suspension should assist in this. Armatures normally caused most failures. The value of new silicone and other insulations was not so much in raising the running temperature as in increasing insulation life. With high-frequency or surge-testing apparatus tests between conductors could be made in the same way as flashing to ground at different stages of repair and manufacture. The answer to fan troubles was not to dispense with the fan but to produce a design which would stand up to arduous service.

Mr. W. J. A. Sykes (British Railways) expressed surprise at the author's figure of 250,000 miles without greasing the armature roller bearings, saying that with the motors for which he was responsible a mileage of only 80,000, which they hoped to raise to 130,000, had been attained. He noted that the author referred to commutator flashovers in the past tense, and was considering the adoption of a totally-enclosed motor, while the Southern Region, which formerly used nothing else, was trying to develop a ventilated motor.

Mr. E. D. Wortley (Crompton Parkinson) criticized the author's statement that the cardon shaft drive was confined to lighter vehicles since it was being used for the Toronto Subway vehicles, with a gross weight of 51½ tons and a tare of 37½. Regarding core banding, the modern tendency was to use slot wedges, not only on account of higher peripheral speeds and reduction of losses but to improve commutation.

Armature Insulation

Mr. W. E. Lewis (G.E.C.), dealing with the need to increase the factor of safety of armature insulation, said that a higher voltage could be specified for the h.v. test, but the motor would be more expensive and probably larger. Controlled bleeding of the oil, which kept the parts continuously covered with a fine film, might increase the life of roller bearings. Resilient gears furnished the best means to get rid of noise and should eliminate many armature failures.

Mr. E. F. Hamilton mentioned that New Zealand was in the throes of developing electric traction, and electrification in the Auckland area would no doubt be mentioned in the present general election.

Mr. A. W. Manser pointed out that the Toronto cars had all the axles motored, so that the motors were small. The cardon shaft was usually spoken of as though it took the whole mass of the motor off the axle, but the Toronto cars had a gear weighing 1,200 lb on the axle instead of the traction motor.

Mr. R. Ledger remarked that London Transport had gone part of the way towards the totally-enclosed motor by eliminating the usual ventilation through the motor core, but he doubted its justification. Mr. E. Webster said that the core ducts became blocked up, so that the motor must be run at less than its designed rating or must be bigger.

Mr. G. Smith referred to the tendency for railways to require an abnormally high pressure for a new brush, so as to avoid adjusting it during its life. Practice in the U.S.A. was to start with 7 to 8 lb/sq in.

Mr. D. E. Dodridge, referring to a suggestion made in the discussion for overcoming wear on brush boxes by fitting pigtails to the brushes, said that one difficulty had been to secure the pigtail so that it did not come out, flap about inside the motor and cause flashovers. Messrs. W. W. Maxwell, J. N. Briggs, A. G. Hopking and N. C. Kew also briefly contributed to the discussion.

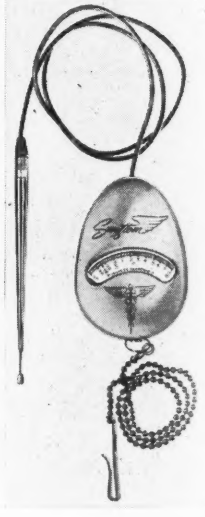
The author, in a brief reply, said that if a roller bearing did not last ten years they were disappointed and if its life exceeded ten years they were very pleased.

Electronic Clinical Thermometer

DETAILS have been received of the "Swiftem" clinical thermometer developed in America. It consists of a tapered stainless-steel tube 4" in long, the probe, which takes the place of the glass tube of the conventional instrument and a temperature indicating unit.

At the tip of the probe is a heat-sensitive resistor, $\frac{1}{32}$in in diameter by $\frac{1}{16}$in long, which varies the current supplied by a mercury-cell battery in proportion to the temperature of a patient. The battery operates over a wide range of temperature and is unaffected by atmospheric humidity. It is contained in a plastic case which also houses a meter indicating temperatures in degrees F on a luminous dial. This indicating unit can be held easily in the palm of the hand and it has a push-button on the side of the case which is pressed when a reading is to be taken.

A patient's temperature can be indicated with high accuracy in from three to five seconds, and it can be recorded continuously in a distant control room. The length of the connecting cord does not affect the sensitivity or accuracy of the instrument. The mercury-cell battery is believed to have an operating life of 750 hours. This thermometer was invented by Col. George T. Perkins, an army dentist, and was developed with the co-operation of a hospital radio technician and by the Burlington Instrument Co., Burlington, Iowa. The company plans to make it commercially available for civilian use within a few months at a reasonable price. It also expects to develop other models suitable for home and industrial use.



The "Swiftem" electronic clinical thermometer

PERSONAL AND SOCIAL

News of Men and Women of the Industry

Londonderry Corporation Electricity Committee has decided that **Mr. S. A. Spence,** chief assistant electrical engineer, should be appointed acting city electrical engineer, following the death of Mr. R. V. Macrory. The position is to be advertised.

Mr. Forbes Jackson, M.I.E.E., M.I.Mech.E., deputy engineer-in-chief of the London County Council, has retired after twenty-one years' service with the Council. Mr. Forbes Jackson was trained at the Chelmsford works of Crompton & Co., and after a period with the British Thomson-Houston Co., Ltd., joined Merz & McLellan in 1922, serving in their London office and in India. He joined the L.C.C. service as chief of the electrical division in 1933 and in 1952 became deputy engineer-in-chief. During the 1914-18 war he was in the R.N. Divisional Engineers and served in Gallipoli and in H.M.S. "Princess Royal." Mr. Jackson has actively participated in electrical installation matters as a member of the Post-War Building Studies Committee for Electrical Installations (Ministry of Works) and the Codes of Practice Committee (under the auspices of the I.E.E.) and has represented the I.E.E. on the National Register of Electrical Installation Contractors. He was chairman of the I.E.E. Installations Section in 1945-46, having previously been vice-chairman. He was a joint recipient in 1943 of the Swan Premium of the I.E.E. and of the Crompton Premium in 1946. Mr. Jackson directed the entire electrical installation of the Royal Festival Hall and the floodlighting of the County Hall for the Coronation last year.

Mr. Forbes Jackson

H. Fisher (Oldham), Ltd., have appointed **Mr. W. E. Hindle** (late of Hoover, Ltd.) as production manager, **Mr. S. J. Watts** (late of General Gas Appliances) as purchasing manager, and **Mr. W. P. Pache** (late of Hoover, Ltd.) as service manager.

Mr. E. Green, M.Sc., having reached the retiring age, has, with effect from 1st November, relinquished his position as head of the Transmitter Advanced Development Group of Marconi's Wireless Telegraph Co., Ltd. He is, however, continuing his work for the company on a full-time basis as a consultant engineer. As from this date, the scope of what has hitherto been known as Transmitter Advanced Development Group has been considerably increased, and the organization is now termed Advanced Development.

Mr. V. J. Cooper, B.Sc., A.C.G.I., M.I.E.E., M.Brit.I.R.E., Assoc.I.R.E., has been appointed chief engineer, Advanced Development, with effect from 1st November.

Mr. Green joined the Marconi Co. in 1913. From 1919-1929 he assisted Mr. C. S. Franklin in the development of the Marconi short wave beam system. In 1929 he was appointed chief of the high-power short wave transmitter group.

Mr. Green has more than fifty patents to his credit, and is the author of a great many technical articles. His latest work is the recently-published text-book, "Amplitude-Frequency Characteristics of Ladder Networks."

Mr. E. Green

Mr. V. J. Cooper

Mr. Cooper joined the company in 1936, and since that time has been in continuous association with development work on the Marconi range of transmitters. During the war years he was engaged on Government work. Since the war Mr. Cooper's activities have been concentrated chiefly upon the development of television transmitters. He has written many technical articles and his practical contribution to present-day techniques is covered by nearly forty patents.

Sir John Cockcroft, K.C.B., has been awarded one of the two Royal Medals for the current year by the Royal Society with the Queen's approval.

Mr. H. Kline, M.C., A.M.I.E.E., has been appointed installation manager of William Steward & Co., Ltd., in succession to **Mr. A. H. Jones,** who is retiring. Mr. Kline received his education at the Poplar Technical College and followed this by an apprenticeship with Pinching & Walton, Ltd. War service in the Royal Engineers was followed by appointments in the Chief Engineer's Department, London County Council, and in the technical division of Unilever, Ltd. He at present commands an E. and M. Squadron in the Army Emergency Reserve.

Mr. H. Kline

At a farewell gathering **Mr. J. W. C. Milligan,** who recently relinquished his post as managing director of the Brush Electrical Engineering Co., Ltd., was presented with gifts from his former colleagues, comprising a carved walnut cocktail table, a walnut wall corner cabinet and a cheque for the purchase of silver. Mr. J. H. R. Nixon, technical director, made the presentations.

Mr. G. R. Scott-Farnie, general manager of International Aeradio, Ltd., has been invited to attend the Sixth Annual Electronic Conference of the Institute of Radio Engineers of America to be held in Kansas City on 18th and 19th November, and to be principal speaker at the banquet in connection with the conference.

Sir John Dalton, chairman of W. T. Henley's Telegraph Works Co., Ltd., is shown electronic testing of Henley earth-leakage circuit-breakers at the exhibition "From Raw Material to the Finished Product," held in conjunction with the recent Henley students' conversazione

English Electric apprentices receiving awards from the Countess of Shrewsbury. Left to right: Mr. J. R. Sully (general manager, Stafford), Mr. H. Kirby (foreman, pattern shop), Mr. J. Peake, the Countess of Shrewsbury, Mr. W. Green, and the Mayor of Stafford (Councillor C. Jones)

The annual presentation of craft and students apprentices' indentures and awards of the **English Electric Co., Ltd.,** was held at Stafford on 12th November. The presentations were made by the Countess of Shrewsbury. In his annual report Mr. E. G. Carwardine, education superintendent, Stafford, reminded his listeners that the English Electric system of training was unsurpassed. It differed from others in that it had no set programme applied to all the boys en masse, but it involved a special programme for each boy. Mr. J. R. Sully, general manager, Stafford Works, also spoke, and Mr. Ian Smith, on behalf of the apprentices, thanked the English Electric staff for their attention during the past year and for the evening's arrangements in particular.

The annual dinner of the Long Service Association of the **Micanite & Insulators Co., Ltd.,** was held on 16th October, and was attended by ninety-three members and eighty guests, with the president, Mr. H. A. Cooper, presiding. Eighteen members qualified for the gift, value £25, awarded by the company after completion of twenty-five years' service. The presentations were made by Mrs. Cooper. The toast to the Association and the company was proposed by Mr. A. Morris of the Estimating Department and replied to by the chairman. Mr. G. Turner (Inspection Department) proposed the toast of the ladies and guests, to which Miss G. Sapsford of the Accounts Department responded.

OBITUARY

Mr. E. J. Frank, late managing director of E. F. Electric, Ltd., Watford, died suddenly at his home on 10th November. The business will continue as before and the policy remain unchanged.

Mr. A. H. Ginman.—The death took place in Canada, on 7th November, of Mr. Albert Harry Ginman, a former president of the Canadian Marconi Co. He was seventy-nine. Mr. Ginman was born in Surrey and joined the Post Office staff as a telegraphist, subsequently transferring to the Cuba Submarine Telegraph Co., Ltd. (later merged with Cable & Wireless, Ltd.). At the age of twenty-seven he joined Marconi's Wireless Telegraph Co., Ltd., and worked with Marconi himself. He was transferred to the American Marconi Co. in 1902, but returned to the parent company in England in 1917 and shortly after went to the Far East, where for twelve years he acted as the company's general representative in China and Japan. Returning to England in 1929, he was appointed joint general manager of the Marconi Co., and later became general manager. In 1935 Mr. Ginman relinquished this position to take up the presidency of the Canadian Marconi Co. and the post of general manager in Canada of Cable & Wireless, Ltd. He relinquished the position of president of the Canadian Marconi Co. in 1951, but remained a member of the board.

Mr. Fred Smith, chief electrical engineer at Pinxton Collieries, died on 13th November. Mr. Smith had been electrician at the collieries for over fifty years and had been chief electrical engineer for over forty years. He was a founder-member of the Midland Branch of the Association of Mining Electrical and Mechanical Engineers and had served on its Council for a number of years.

Mr. F. T. Alldread, former director of George E. Taylor & Co. (London), Ltd., electrical engineers and contractors, died on 14th November after a long illness.

Mr. A. D. Constable.—The death occurred on 12th November at Weybridge, Surrey, of Mr. Arthur Douglas Constable, O.B.E., F.C.G.I., M.I.E.E., who was Director of Electrical Engineering at the Admiralty from 1934 to 1937. Mr. Constable was at the Central Technical College from 1892 to 1895 and subsequently held various appointments with the India Rubber, Gutta Percha & Telegraph Works Co., Ltd., and in the Croydon Corporation Electricity Department. He was chief assistant at the Chatham & District Light Railway Co.'s power station from 1902 to 1903 when he entered Admiralty service. From 1904 to 1913 he was electrical engineer at the Bermuda and Gibraltar Dockyards and he joined the late Mr. C. H. Wordingham at the Admiralty in 1913, becoming Assistant Director of Electrical Engineering in 1918 and Deputy Director in 1922, holding that position until his appointment as Director in 1934.

Electrical Industries Ball

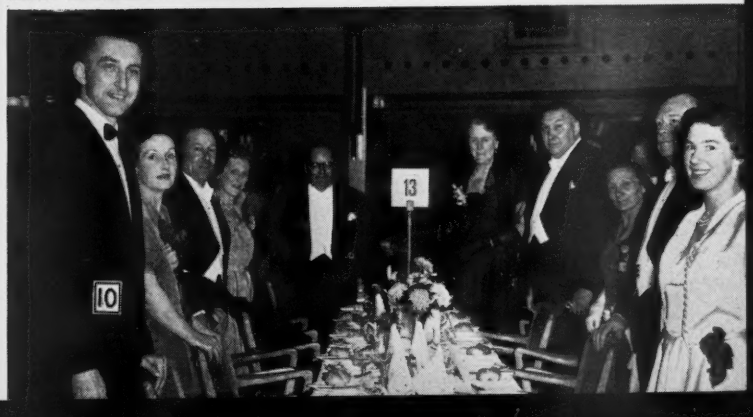
SIR JOHN DALTON, president of the Electrical Industries Benevolent Association, and Lady Dalton, received over eleven hundred guests in the Great Room at Grosvenor House, London, last Friday, on the occasion of the Association's annual ball. Many of those present had travelled from as far as Scotland and Ireland to attend the function. In the course of the evening, Sir John read a telegram from Her Majesty the Queen which had been received in reply to a message of loyal greeting.

During dinner music was provided by the Chamber Ensemble, and later Eric Robinson's Television Orchestra played for dancing. The midnight cabaret included some lively spectacles from the Lynbahrys, Arab tumblers, and Koba and Kalee, Indian novelty dancers. Dennis Robertson, well known as " Mr. Bun " in the children's television series, proved the fascination of the mime, and Igor Gridneff gave an exciting display of ladder balancing.

In addition to the £1,000 received from the sale of tickets the Association benefited to the extent of over £800 from the sale of programmes and a collection. Holders of forty lucky programmes received attractive prizes presented by electrical manufacturers' and other organizations.

Some of the 1,100 people at the E.I.B.A. Ball *(See opposite page)*

1. Mr. H. Senior Fothergill (secretary, E.I.B.A.), Sir John Dalton (president), Mr. H. A. Deacon (chairman) and Mr. A. E. Page. 2. A G.E.C. group. 3. Among this party are Messrs. C. R. King, J. Mortimer Hawkins, W. B. Poulter and A. N. Irens. 4 The President's table. 5. Mr. Geoffrey Falk's party. 6. The electrical wholesalers' assembly. 7. Mr. D. D. Walker and Evershed & Vignoles colleagues. 8. Siemens' table, with Mr. C. A. Hughes and Mr. Forbes Jackson. 9. Mr. Hawes Davison, Mr. H. S. Fothergill, Mr. N. V. Castling and Mr. and Mrs. V. A. Pask. 10. Mr. H. A. Deacon's table



Parliamentary Report

IN the House of Commons on Monday, Sir Robert Perkins asked the Minister of Fuel and Power whether he was aware that Electricity Boards asked applicants for such posts as that of meter reader/collector for their political and religious views and, in view of the fact that applicants felt that the wrong answer might prejudice their applications, whether he would give a general direction to the Authority that questions of this kind should cease to be asked.

Mr. Geoffrey Lloyd, Minister of Fuel and Power, said he agreed that such questions were liable to lead to misunderstanding and were best avoided. He had no reason to suppose that they are commonly asked. The methods adopted by Boards in interviewing prospective employees were their own managerial responsibility and a general direction on this subject would not be appropriate or necessary, but he was taking steps to see that his views were fully understood by the Boards.

Decline in Load Factor

Mr. Nabarro asked the Minister of Fuel and Power whether he is aware that the load factor of publicly owned power-houses had fallen from 47·1 per cent in 1950–51 to 44·7 per cent in 1952–53 and 43·9 per cent in 1953–54, and as this reflected a decline in occupational efficiency of valuable national assets at a time of rising general industrial productivity, what regard he was having to these trends when sanctioning new power-house constructional programmes of the B.E.A.

Mr. Geoffrey Lloyd replied that the relatively high load factor in 1950–51 was achieved only by the use of old plant and resort to load shedding. The load factor had fallen since then because the B.E.A. had installed enough new capacity to avoid load shedding, reduce its reliance on old plant and thus raise the efficiency of the system. The efforts of the B.E.A. to diversify the load, however, should lead in future years, as the development programmes to which he had recently given his general approval were carried out, to a steady improvement in the load factor.

Kent Power Station Site

Asked by Mr. John Arbuthnot if he would make a statement on the position regarding the projected power station at Richborough, Mr. Geoffrey Lloyd said that the B.E.A. had made no application to him for his statutory consent to build a station at Richborough. He was aware, however, that the Kent County Council had shown in the town development plan a site for a generating station but that the B.E.A. had not yet been able to obtain the permission of the landowner to enter the site or make the trial borings which were essential before any design work could be done on the project.

Consultative Council Committees

In reply to Mr. Watkins the Minister said that Local or District Committees were appointed by the Electricity Consultative Councils themselves and not by himself. Requests for representation for Parish Councils, or any other interests, would therefore be for the Consultative Councils themselves to consider in the light of the various claims to representation on the Committees.

Fuel Efficiency

Mr. Palmer asked the Minister if, in view of the large sums of money which had had to be provided by the nationalized fuel and power industries for the establishment of the new Fuel Efficiency Company, and the objections raised, he would reconsider his previous decision against a levy to enable private industry to contribute to the funds of the company.

Mr. Geoffrey Lloyd replied "No, sir."

Mr. Palmer asked the Minister if he would state the number and value of interest-free loans made so far by the new Fuel Efficiency Company to private industrial concerns for the installation of fuel-saving equipment.

Mr. Geoffrey Lloyd said that there was a Government scheme under which loans could be made that were free of interest for the first two years, and he had so far approved 95 such loans totalling nearly £700,000.

Proposed New Tube Railway

The Ministry of Transport announced on Monday that the Minister had consented to the inclusion in the British Transport Commission's private Bill, which was to be introduced next session, of powers for the construction of the proposed new underground railway from Victoria to Walthamstow. Neither the Government nor the Commission, however, could yet enter into any commitment to carry out the project.

PROSPECTS IN EGYPT

In the opinion of the Minister (Commercial) at the British Embassy, Cairo (as expressed in the *Board of Trade Journal*) prospects for United Kingdom exports to Egypt are now more promising. Reference is made in the article to the hydro-electric station now under construction at the existing (low) Aswan Dam and the new power station in Cairo which is expected to be in full operation next year, as well as to a second Cairo station for which tenders have already been received. Some power will also be available eventually from the projected high Aswan Dam. It is stated that the linking of these stations will mean a useful demand for transmission line equipment, transformers and switchgear. There are likely to be demands from provincial towns and industries for diesel generating sets.

The possible demand for domestic electrical appliances is mentioned, but here competition is expected to be fierce.

B.E.A. CONTRACTS

Contracts have been placed by the British Electricity Authority during the past month for power stations, transforming stations and transmission lines amounting in the aggregate to £3,747,776, including the following:—

Brighton "B" power station: Two 72 MVA 34·8/11·6 kV generator transformers.—English Electric Co.

Brimsdown "B": 33 kV and l.v. cables and accessories.—Aberdare Cables.

Willington "A": Superstructure.—Marples, Ridgway & Partners.

Lincoln: Administration block. — Wm. Moss & Sons.

Bold "A," St. Helens: Two 36 MVA, 11·8/33·4 kV generator transformers.—Metropolitan-Vickers Electrical Co.

Portobello, Edinburgh: Circulating water pumps, pipework, valves and strainers.—Drysdale & Co.

Bristol and Birmingham grid control areas: Standardized indication and telephone equipment.—General Electric Co.

Thames North and Leeds grid control areas: Standardized indication and telephone equipment.—Standard Telephones & Cables.

Agecroft, Salford: 132 kV, 3,500 MVA switchgear.—Metropolitan-Vickers.

Penwortham substation: 275 kV, 7,500 MVA switchgear.—Ferguson, Pailin.

Rochdale substation: Site and foundation works.—Leonard Fairclough.

Warrington substation: Modifications to 132 kV switchgear and equipment.—Ferguson, Pailin.

Dalmarnock substation: 132 kV 2,500 MVA switchgear.—Metropolitan-Vickers.

PRICES OF MATERIALS

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM Ingots	ton £156 0s 0d
COPPER, H.C. Electro	ton £277 10s 0d
Fire Refined 99·70%	ton £275 0s 0d
Fire Refined 99·50%	ton £274 0s 0d
COPPER Tubes ..	lb 2s 7⅞d
Sheet	ton £336 5s 0d
H.C. wire and strip ..	ton £308 5s 0d
LEAD, English ..	ton £111 5s 0d
Foreign	ton £109 10s 0d
MERCURY	flask £110 0s 0d
TIN, block (English) ..	ton £722 0s 0d
ZINC, G.O.B. Foreign	ton £81 15s 0d
Electrolytic	ton £85 10s 0d
BRASS Tubes (solid drawn)	lb 2s 1⅛d
Sheet	ton £270 5s 0d
Wire	lb 2s 8⅛d
PHOSPHOR BRONZE Wire	lb 4s 1⅜d
PLATINUM	oz £30 0s 0d
RUBBER, No. 1 R.S.S. spot	lb 25⅛d–25½d

Fire at Wednesbury Works

Wm. Sanders & Co. (Wednesbury), Ltd., announce that following the recent fire at their premises, production of switchgear and accessories has been restored in full.

INDUSTRIAL NEWS

Electrical Engineers' Exhibition

Lord Citrine, chairman of the British Electricity Authority, has consented to open the 1955 Electrical Engineers' Exhibition (Earls Court, 18th–19th March). There will be over 230 exhibitors, an increase of over a third.

The main theme of the exhibition will be the "British Electric Motor" and at the end of the hall will be a display called "Motor Way", where one of all types of specialized electric motors will be shown. Further information and tickets can be obtained from Mr. P. A. Thorogood, general manager, Electrical Engineers' Exhibition, 23, Bloomsbury Square, London, W.C.1 (Museum 3450.)

Electrical Equipment for Steelworks

The General Electric Co., Ltd., has received a contract from Dorman Long (Steel), Ltd., for electrical plant and control gear valued at £250,000. The order covers electrical equipment for the auxiliary drives of a combined universal beam and heavy section mill for the new works at Lackenby, and includes nearly 6,000 h.p. of mill type motors. Ten synchronous motor-generator sets will provide the d.c. supplies for the mill motors. The control gear, which embodies the G.E.C. control exciter system, includes five switchboards of the flatback contactor type.

M-V Apprentices' Club

On 1st November Dr. C. Dannatt, managing director, Metropolitan-Vickers Electrical Co., Ltd., opened "Kenwood," Stretford, as a non-residential social club for the company's apprentices. The premises, which during the war were used by the company as offices, have been considerably altered as well as being completely redecorated and refurnished. The accommodation available includes an assembly room suitable for indoor games, lecture meetings and dances, a large lounge, a refreshment room, and a study. The study, which is a room in a cottage adjacent to the main building, will be particularly welcomed by apprentices who are in lodgings and who have no suitable place for private study and homework. General management of the club is in the hands of a committee, under the chairmanship of Dr. Willis Jackson, director of research and education, and day-to-day matters are dealt with by a house committee.

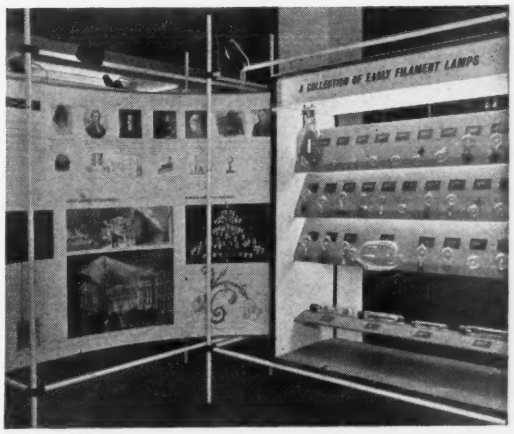
Part of the lounge of "Kenwood," the new club of the M-V Apprentice Association

B.T.H. Lamp Showroom

With the opening of the new "Mazda" lamp and lighting showroom at Crown House, Aldwych, W.C.2, the British Thomson-Houston Co., Ltd., is celebrating not only its own 75th anniversary but also the anniversary of the first incandescent lamp. The first exhibition in the showroom is fittingly devoted to the development of electric lighting since 1879 against a background of progress in lighting throughout the centuries.

A unique collection of electric lamps is on show covering the period 1880 to the present day. The earliest exhibit is a Phœnician oil lamp dated about 1500 B.C. while the two latest are the "Mazda" 1 kW horizontally operated mercury vapour discharge lamp and a 10 kW projector lamp which is used in colour film studios.

A new form of trunking is also on show for the first time. Known as "Invertrunking," it is installed as a permanent feature of the showroom, supported by rods 2ft below the primary ceiling. It carries wiring and fittings and provides complete flexibility of lighting layout. Other exhibits include a germicidal lamp, a FA.5 xenon flash tube, models demonstrating the design of the new cathodes used in fluorescent lamps and an exhibit on ultra-violet lighting for aircraft instrument panels. In addition to several colour comparison exhibits the working principle of the fluorescent lamp is shown with the aid of diagrammatic models. Other sections are devoted to domestic, industrial and street lighting, special lamps and lamps and flash bulbs used in photography.



One of the exhibits in the B.T.H. lamp and lighting showroom which includes a collection of early filament lamps

Automatic Cooking

Much is now being made of the ability of the modern electric cooker—not shared by any other type—to produce meals automatically and at a predetermined time. There is a certain technique involved and Miss Ester Purvis has produced a booklet ("Electric Automatic 'Coldstart' Cookery") which explains the methods and gives a number of recipes, including ten for complete meals. The booklet (price 4s 6d) is obtainable from the Landwood Distributing Co., Ltd., 18, Cowcross Street, London, E.C.1.

Reading House Wiring Tenders

By 26 votes to 25 Reading Town Council at its last meeting referred back to the Finance and General Purposes Committee a decision to accept the tender of the Southern Electricity Board for wiring 103 pre-war houses at a cost of £1,556. It was stated that the lowest tender was £1,313 and the highest £4,363. Councillor A. Lockwood said that the lowest tender was from a local firm but the borough surveyor had reported that in his opinion the tender was not satisfactory for a job of that magnitude. The next two tenders (£1,440 and £1,500) were from firms at Birmingham and Evesham and it was thought that it would be difficult to get into contact with them during the maintenance period.

Councillor E. A. Busby, who moved

New Crypton training school for service station men on the North Circular Road, London

the reference back, contended that where tenders had been publicly invited and a private firm was capable of carrying out the work, there was a moral obligation to place the contract with that firm.

Councillor R. A. Bradley said that it was proposed to give consideration to the installation of electricity in a further 1,742 houses, so that whatever they did would be multiplied 17 times in the future. No one had gone into the matter sufficiently to know whether the contractors at Birmingham and Evesham had work in the area already.

Aluminium Subway Cars for Canada

Four aluminium alloy cars have just been completed by the Gloucester Railway Carriage & Wagon Co., Ltd., for Canada's first underground railway system opened last spring in Toronto (see *Electrical Review*, 30th April, page 801). It was decided to build these cars, with two more to follow, in order to assess the economics of aluminium construction for this type of vehicle. Since the aluminium cars are identical in general design, capacity and power to the steel ones, a direct comparison of performance and operating costs will be possible.

All the 100 steel cars now in service were also supplied by the Gloucester Railway Carriage & Wagon Co.

Mine Lamp Contract

A contract has been received by Oldham & Son, Ltd., from a number of West African gold mining companies for the hire and maintenance of over 6,000 miners' cap lamps. The companies include the Ashanti Goldfield Corporation, Bibtani (1927), Ltd., Ariston Gold Mines (1929), Ltd., and Gold Coast Main Reef, Ltd. Under the contract Oldhams are responsible for the maintenance of the new installations and one of the company's engineers has gone to West Africa to supervise the service. The mines formerly used carbide type lamps (acetylene). The Oldham lamps will be installed at twelve shafts and the installations will range in size from 150 lamps to 2,000 lamps. The working conditions in the mines are such that special reflectors giving a strong diffused beam are being fitted to the lamps supplied.

Crypton Training School

Crypton Equipment, Ltd., has had a training school in operation at its Bridgwater works since 1948. Now in addition a school has been opened in London and in fully equipped premises on the North Circular Road a new series of weekly training courses has just started. The main object of the school is to instruct service station men in the workings of the internal combustion engine (particularly engine and electrical fault diagnosis) and to train operators to use the Crypton engine electrical testing equipment on motor transport.

New Cooker Demonstrated

Last week the Jackson Electric Stove Co., Ltd., introduced its new "Two-Nine-Three" cooker to a gathering of the trade and lay Press at the Charing Cross Hotel, London. Mr. S. C. Hurry, chairman and managing director, broadly described the principal points of the cooker and introduced Mr. S. F. Steward, chairman of the Council of the British Electrical Development Association, who spoke of the rapid advance electricity was now making in industry and the home. There followed a talk and demonstration by Mrs. M. A. Scallan, one of the company's senior demonstrators.

Mr. S. C. Hurry, chairman and managing director of the Jackson Electric Stove Co., opening the demonstration of the "Two-Nine-Three" cooker

The new cooker is pleasing in appearance and complies with E.D.A. specification for interchangeability of parts. The oven, which is large enough to accommodate a 30 lb turkey, has a loading of 2,100 W and is finished in vitreous enamel. The hob equipment comprises two boiling plates, measuring 8in and 6¼in in diameter, and a grill boiling plate measuring 10½in by 8in, the respective loadings being 1,800 W, 1 kW and 2 kW. "Simmerstat" control is fitted as standard to the 8in plate and is an optional extra for the smaller plate and grill boiler.

Built-in drying rails are provided on each side of the cooker for the oven cloth or the airing of small articles. The back legs are fitted with rollers and the large storage drawer (an optional extra) is removable to facilitate cleaning of the back wall or floor.

The overall dimensions of the cooker are 23½in wide, 25½in deep by 36in high (with splash plate, 44in). A colour choice is offered of cream with pale green legs, all cream or white with pale grey legs. The price, which is claimed to be the lowest for an electric cooker of its type, is £27 10s, the drawer model being £1 more.

The Bagdad Fair

At a Press conference held in London last week Sir Norman Kipping, Director-General of the Federation of British Industries, gave a general impression of the recent Bagdad Trade Fair and its results. He said that the number of visitors (330,000) exceeded all expectations and included trade buyers not only from Iraq, but also from Lebanon, Syria, Jordan, Saudi Arabia, Kuwait, Bahrein and Persia, and even as far afield as the Sudan, India and Pakistan. Although it was not possible at this stage to make an assessment of business done, practically no product on show remained unsold. Substantial sales and numerous inquiries were made for such consumer goods as domestic appliances, including

cookers, washers, mixing machines and weighing machines; radio and telecommunications equipment; refrigerators; heavy electrical equipment; and air conditioning plant. The people of Iraq had been intensely impressed by the Fair.

Speaking of trade prospects in the Middle East Sir Norman said that with the income of those countries increasing, it was estimated that something like £200 million a year would be spent on their development, and this would provide a great market for capital and consumer goods. At a time when competition was fierce, the Fair had done much to bring before the people of the Middle East the quality of British products. It had also shown British firms who had not hitherto explored the market, its potentialities.

F.B.I. Register

An important new feature of the 1955 edition of the F.B.I. Register of British Manufacturers (1,089 pages) is the French, German and Spanish glossaries, each of which gives a translation of every heading used in the buyers' guide, the headings being numbered for easy reference.

There are eight sections, each one having a reinforced index card for ease of reference. These include a buyers' guide which classifies over 6,800 F.B.I. member firms under more than 5,000 trade headings and a comprehensive alphabetical directory of these firms. In other sections will be found useful information about trade associations, proprietary names, trade marks, etc. The introductory information and detailed instructions on the use of the Register are translated into French, German and Spanish.

The Federation of British Industries, as the president, Sir Harry Pilkington, says in the foreword, has always considered that one of its many functions is to show the buyer where to go to make his choice on the basis of price, quality, delivery and service. The F.B.I. Register has played an important part in discharging that function since 1920.

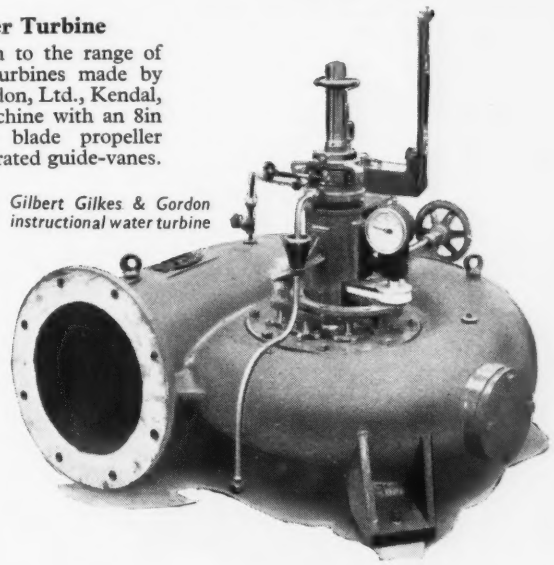
The Register is published for the Federation of British Industries by Kelly's Directories, Ltd., and Iliffe & Sons, Ltd., Dorset House, Stamford Street, London, S.E.1, at 42s (including postage).

Illuminated Signs

The Franco-British Electrical Co., Ltd., is now producing illuminated signs made in plastic. New additions to its range include "Lumore" letters in translucent "Perspex." This material is used for the sides as well as the face of the letters, and the tube is totally enclosed preserving the clean lines of the signs. The "Halite" letters have a translucent "Perspex" face and metal returns, and are designed for mounting slightly from the facia, giving a halo effect around the edge of the letter. "Cerata" letters are made throughout in translucent "Perspex." Most of the tubing is enclosed, but at regular intervals this has been made to protrude slightly through small apertures in the face of the letters. Another addition to the range are "Veelite" letters, the neon tubing of which is set in a V-shaped reflector of stainless steel which creates the illusion of a triple tube letter. The face of the letter is in stainless steel, or gold or silver leaf.

Instructional Water Turbine

The latest addition to the range of instructional water turbines made by Gilbert Gilkes & Gordon, Ltd., Kendal, is a Kaplan type machine with an 8in diameter adjustable blade propeller runner and hand-operated guide-vanes. The blade angle is set when the turbine is stopped by means of a hand-wheel at the end of the shaft, and the guide-vane setting can be adjusted while the turbine is running. Two dummy guide-vanes are provided which move with the guide-vanes themselves, thus enabling students to see the shape of the vanes and measure the opening. A series of tests is run with one setting of the runner blades and varying guide-vane openings; the turbine is then stopped, the runner blade setting is altered, and another set of tests run.



Gilbert Gilkes & Gordon instructional water turbine

The turbine has an output of about 4·5 b.h.p. when working on a net head of 10ft, but is suitable for operating on any head from 6 to 15ft. It can be supplied with water from an axial flow or centrifugal pump or from an overhead tank. About 1,500 to 2,000 gal/min of water is required according to the head upon which the turbine is working. The power is measured by a delicate Prony brake with a water-cooled drum, and a tachometer and pressure gauge are included as a part of the machine. An interesting feature is the ease with which the turbine can be opened up to show the relative setting of the runner and guide-vanes.

New Mercury Discharge Lamps

A footnote to the article bearing this title in our 5th November issue may have suggested that other E.L.M.A. companies than those mentioned were not making their own discharge lamps. This is not so as they, too, have their own research and manufacturing facilities for a wide range of electric discharge lamps.

Siemens Electric Lamps & Supplies, Ltd., inform us that they are among the manufacturers of the new lamp.

Indian Tariff on Lampholders

While it accepts a recommendation of the Tariff Commission that protection of the electric brass lampholder industry should continue up to 31st December, 1956, the Indian Government does not agree with the proposal that the standard rate of import duty should be lowered to 31½ per cent, with a preferential rate under the Indian-British Trade Agreement. It is pointed out that conditions for importers are now easier. The Government is not satisfied with the organization and marketing methods of the industry and proposes to take steps to improve them.

Hoover Window Display Contest

Selfridges, Ltd., Oxford Street, London, have won the national first prize of 100 guineas and a challenge cup, for the best window in the recent Hoover window display contest.

Trade Announcements

The **Jackson Electric Stove Co., Ltd.,** announces that Mr. F. Woolnough, who was until recently its technical representative in the Northmet and Essex Sub-Areas of the Eastern Electricity Board, is now responsible for sales in the Chilterns, Fens, Norfolk and Suffolk Sub-Areas. Mr. A. G. Allen, who has been technical representative for the last four years in certain Sub-Areas of the London and South Eastern Electricity Boards, will take over responsibility for sales in the Northmet and Essex Sub-Areas.

F. C. Robinson & Partners, Ltd., have acquired larger premises at 122, Seymour Grove, Old Trafford, Manchester, 16, and their head office, sales, service and contracts departments will operate from this address as from 13th December. The telephone number will be Chorlton 5366. The move does not affect the factory at Councillor Lane, Cheadle, Cheshire.

NEW ELECTRICAL EQUIPMENT

Automatic Iron

The latest thermostatically controlled iron ("Milady's Iron") announced by H.M.V. HOUSEHOLD APPLIANCES, Hayes, Middx., is provided with an insulated cool-grip handle with thumb rest on both sides and weighs approximately 4 lb. The body is finished in vitreous enamel and a chromium soleplate distributes the heat evenly over the entire surface.

The loading is 750 W and automatic heat regulation is by means of a large control knob with settings for different materials clearly marked.

The iron is "suppressed" for radio or television interference, and is available in 200/220 V, 220/240 V or 240/250 V a.c. or a.c./d.c. models. The retail price is 39s 6d (a.c.) and 42s 6d (a.c./d.c.).

Left: H.M.V. "Milady's Iron"

Car Kettle

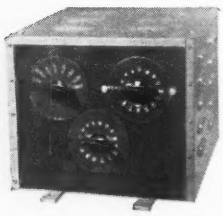
A combined car kettle and teapot introduced by ELTRON (LONDON), LTD., Strathmore Road, Croydon, Surrey, incorporates a removable element, which also serves as a stirrer. It is designed for use on a 12 V car battery supply and has a four-cup capacity.

The heater is inserted through an opening in the lid and plugged into the battery extension. Finished in polished aluminium, the retail price of the kettle is £1 7s 6d.

Right: Eltron 12 V car kettle

Variable Output Transformers

Mains transformers with ratings up to 20 kVA have just been introduced by the MIDLAND COIL WINDING CO., LTD., 4, Lancaster Street, Birmingham, 4, which are designed to cover a range of voltages from zero to any voltage required, a standard being 0–300 V in 15 steps of 20 V. Each position of the tapping switch, which is double pole, gives a 20 V output at the potential corresponding to its position on the winding. Thus there are three output terminals on a separate unit, No. 1-Zero; with Nos. 2 and 3 giving the 20 V output at potentials variable to No. 1. A similar unit is now connected across terminals 2 and 3, so that the 20 V output is again split 15 ways by another double pole switch, and is still at a potential to terminal 1, which is common throughout. This now gives an output at any potential to (1) which is available as just 1·33 V steps. This may now be fed to a third unit in which the 1·33 V is still further split into 15 steps, thus giving a very fine degree of control. This last unit will usually be a single pole type, but can be double pole to enable further division to take place. Thus the outputs of these units can be very large or small, and can be over any range, using either auto or double wound transformers. They can be supplied as complete units, with three control switches on one panel and all mounted in a common case, or as separate units consisting of coarse, medium or fine steps. Metering can be included on the main transformer if required.



Left: "Midco" variable output transformer

Ultrasonic Thickness Gauge

The resonance method of using ultrasonic waves for measuring wall thickness has hitherto involved the variation of the applied ultrasonic frequency manually until maximum noise is heard in the operator's headphones. This method is avoided in the new type 1107 "Visigauge" introduced by DAWE INSTRUMENTS, LTD., 99, Uxbridge Road, London, W.5; both the variation of frequency and the indication of the point at which resonance occurs are carried out automatically by the instrument itself.

For the first of these duties, an electronic oscillator is frequency-modulated over a 2 : 1 frequency range by means of a motor-driven capacitor. The oscillator supplies ultrasonic energy to a quartz crystal which is coupled by a suitable fluid, such as thin oil or glycerine with a wetting agent, to the specimen under test.

When the frequency of the oscillator passes through the resonant frequency of the material, increased power is drawn from the oscillator. This change in power is amplified and the resulting signal is employed to give a vertical deflection on a cathode ray tube. The time base for the tube is synchronized with the operation of the motor-driven capacitor which modulates the oscillator. In this way the horizontal axis on the cathode ray tube represents the frequency of the ultrasonic signal. Since the frequency at which resonance occurs is inversely proportional to the wall thickness, scales can be calibrated directly in wall thickness. Interchangeable scales are available for most of the common engineering materials.

Right: Dawe type 1107 "Visigauge" with cover removed

Medium Duty Trunking

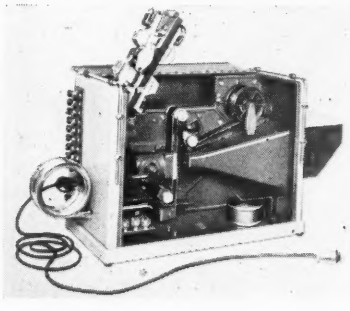
A medium duty metal-clad distribution system which, while having all the installation advantages of the heavy pattern has a lower current carrying capacity, is now available from the GENERAL ELECTRIC CO., LTD., Magnet House, Kingsway, London, W.C.2. The busbar capacity ranges from 75 A to 200 A per bar. Equipment for the system consists essentially of two, three, or four hard drawn copper busbars totally enclosed in sheet steel trunking and supported at frequent intervals by high grade insulating panels. A visible and substantial external copper earth link is provided on the side of the trunking so that each length of trunking and all fittings can be electrically coupled and connected to give an efficient earth throughout the system. Spring contacts are provided at all outlet points to ensure that tap-off unit casings are earthed efficiently before contacts approach the live bars.

Stylus Oscillograph

The OSL81 stylus oscillograph, which has been developed by the Compagnie des Compteurs, Paris, is now available in this country through PARKINSON & COWAN INSTRUMENTS (incorporating Aspec), 7–17, Fitzalan Street, Kennington, London, S.E.11. It can inscribe simultaneously, records of eight separate electrical quantities on a specially prepared 35 mm f.l.n. The response is substantially flat within the frequency band 0–700 c/s.

The basis of the OSL81 is a measuring element of the moving-iron type. Torsion-bar suspension is employed which ensures robust construction, linear response, immunity from drift and high inherent damping. A triangular shaped, light alloy stylus arm is secured at its base to the moving-iron section. Mounted at the tip of the arm is a stylus of hard material which inscribes the record on the film. Provision is made for the adjustment of stylus pressure and stylus arm alignment. The resonant frequency of the element is about 800 c/s.

Each measuring element consumes 0·8 W d.c. or 0·4 W a.c. for a nominal deviation of 0·5 mm. The standard element range available extends from 75 V, 10 mA to 0·75 V, 1 A.



OSL81 stylus oscillograph

LIGHTING NOTES

THE Houghton-le-Spring Urban District Council has issued a report on its scheme for converting street lighting from gas to electricity and states that under present arrangements it would take seven years to complete the scheme as far as Fatfield Bridge. It has been recommended to complete the work in one stage instead of spreading it over seven years. The cost will be £7,000 and the surveyor has been authorized to prepare detailed estimates.

The B.T.H. 25ft concrete street lighting column shown for the first time at this year's A.P.L.E. Exhibition has been chosen for new street lighting installations in DUNDEE and HEREFORD. Hereford City Council has approved a large order for B.T.H. columns and lighting equipment, including nearly 300 of the latest Mazda "Amber" sodium lanterns and over 90 three-lamp fluorescent lanterns for the relighting of the main city streets. An order has also been received for the supply of some fifty Mazda sodium "open" lanterns and gear for Dundee.

MIDDLESBROUGH Town Council is to place orders for lighting columns and equipment in connection with electric street lighting schemes for Cargo Fleet Lane and South Bank Road. The schemes are estimated to cost £5,230 and £2,010 respectively, and the estimates of the North Eastern Electricity Board for the electrical work have been accepted. The Council has approved the spending of £3,692 on improvements to street lighting in various other streets.

WALLSEND Town Council has received loan sanction for £2,290 for improvements to the lighting on the Coast Road, and the North Eastern Electricity Board has been instructed to proceed with the work.

SUNDERLAND R.D.C. has approved a £10,548 scheme for converting street lighting from gas to electricity. About 380 electric lamps will be erected in place of 300 gas lamps.

The ELLESMERE (SALOP), Urban District Council is to accept an offer by the Electricity Board to make a complete survey of the town with a view to adopting electricity for street lighting.

EDINBURGH City Council has approved in principle a scheme for converting street lighting from gas to electricity.

BEDFORD Corporation Highways and Sewerage Committee recommends that application be made to the Ministry of Housing and Local Government for consent to borrow £5,000 for fluorescent lighting in Kimbolton Road from Goldington Road to near Putnoe Lane, any balance being used to extend the fluorescent lighting in Cardington Road.

Blackpool Electrical Services Committee has prepared a provisional estimate of £83,051 for the 1955 autumn illuminations season. The current illuminations are estimated to cost about £79,000.

BARROW-IN-FURNESS Highways Committee has approved schemes for providing street lighting for the North Walney estate (£5,850) and the Margate Street housing site (£1,370).

NEWCASTLE-ON-TYNE City Council has received loan sanction for £10,800 for the provision of electric street lighting on the North Kenton and Fawdon estates.

WELLINGBOROUGH U.D.C. is to spend £48,000 on a new street lighting scheme.

A recent award by the Kuwait Development Board marks the beginning of a new street lighting system for the township of Kuwait. Orders for "Adastra" columns and lanterns to the value of £130,000 have been placed with Poles, Ltd. The special designs for this equipment were drawn up by the architects for the township, Messrs. Minoprio and Spenceley, jointly with the Department of Electricity. The main road columns (25ft mounting height) will carry lanterns of ornate design housing fluorescent and tungsten lamps, both individually and in combination. For side streets tungsten lamps will be used at a mounting height of 15ft. The smoothly tapering columns are to be finished in a bright colour in order to contrast with the arid brown of their surroundings.

Certain of the fittings are being manufactured by the Revo Electric Co., Ltd. That shown in the left-hand illustration has a 36in long tapered opalescent "Perspex" cylinder and is arranged for eight 3ft, 30 W fluorescent lamps internally and eight 150 W tungsten lamps externally, under the dome. The tapered cylinder is made to slide down the column to facilitate relamping and cleaning. The dome, which is 4ft 3in in diameter, houses the control gear. Surmounting the dome is a decorative finial. The second fitting illustrated is for use at roundabouts. This graceful original design incorporates three "Perspex" cylinders mounted in copper domes supported on strong steel brackets. Each cylinder is fitted with four 30 W 3ft fluorescent lamps and is arranged so that the cylinder slides down over the brackets to give access to the interior.

Street lighting fittings for Kuwait

Ceylon's Electrical Imports

THE value of Ceylon's imports of electrical machinery and apparatus in 1953 was Rs. 33,199,000, an increase of about 15 per cent on 1952. The principal items are shown in the accompanying table, with notes of increases or decreases on the previous year. Outstanding among the former were wires and cables not rubber insulated, telegraph and telephone instruments, and motors. A new heading reveals an appreciable import of cooking and heating apparatus. British trade in radio apparatus suffered a setback in the face of German and Netherlands competition. (13½ Ceylon rupees=£1.)

Class of Goods	1953 Rs (000)	Inc.or dec. on 1952 Rs (000)
Control and switchgear ...	1,900*	+ 241
Transformers and convertors	1,248*	+ 623
Generators, alternators, dynamos and exciters ...	1,502	— 182
From U.K.	1,093	— 403
,, *U.S.A.*	45	— 5
,, *Germany*	66	— 71
,, *Switzerland* ...	288	+ 288
Motors...	1,472	+ 663
From U.K.	1,059	+ 319
,, *U.S.A.*	28	— 19
,, *Germany*	330	+ 330
Electrical machinery not elsewhere specified	2,696	+ 48
From U.K.	1,414	+ 107
,, *Australia*	16	— 226
,, *U.S.A.*	777	+ 94
,, *India*	189	— 23
Rubber insulated wires and cables	2,133*	— 323
Other electric wires and cables	3,110*	+ 1,784
Fluorescent tubes	167	†
From U.K.	104	†
,, *Netherlands* ...	44	†
,, *U.S.A.*	19	†
Electric torches	916	†
From U.K.	13	†
,, *Hong Kong* ...	831	†
,, *U.S.A.*	71	†
Other lamp bulbs	658	+ 378
From U.K.	504	+ 338
,, *Japan*	8	— 2
,, *Germany*	59	+ 39
,, *Netherlands* ...	63	— 10
Torch bulbs	220	+ 68
From U.K.	3	— 12
,, *Hong Kong* ...	26	— 20
,, *Netherlands* ...	151	+ 150
,, *U.S.A.*	33	— 56

Class of Goods	1953 Rs (000)	Inc.or dec. on 1952 Rs (000)
Radio instruments and apparatus	3,628	— 728
From U.K.	2,185	— 848
,, *U.S.A.*	102	— 260
,, *Netherlands* ...	910	+ 261
,, *Germany*	305	+ 159
Other telegraph and telephone instruments (except batteries)	2,242*	+ 1,389
Electric cooking and heating apparatus	464	†
From U.K.	400	†
,, *Germany*	31	†
Lighting accessories, fittings and switches	1,539	— 1,303
From U.K.	1,313	— 315
,, *U.S.A.*	26	— 130
,, *Japan*	19	— 3
,, *Germany*	53	— 33
Batteries, dry, radio ...	562	+ 346
From U.K.	483	+ 299
,, *Germany*	21	— 2
Ditto, other than radio ...	4,328	— 295
From U.K.	1,032	+ 182
,, *Malaya (including Singapore)*	2,975	+ 1,098
,, *U.S.A.*	254	— 196
Other batteries and accumulators except splash proof for motor vehicles... ...	159*	+ 133
Electrical goods and accessories not elsewhere specified	4,256	+ 406
From U.K.	3,465	+ 304
,, *U.S.A.*	209	— 1
,, *Japan*	17	— 58
,, *Germany*	87	— 94
,, *France*	290	+ 261

* Mainly from U.K. † Comparative figures not available.

Financial Section

STOCKS and SHARES

STOCK Exchange markets have been going through one of the sharpest of those reactionary phases which must be expected to punctuate any long rise in security prices. No very substantial reason appeared to account for an abrupt change from buoyancy to depression in the market atmosphere. Part of the reason lay no doubt in a certain amount of over-optimism in previous buying, and with the disposition of short-term investors to take profits at any sign of reaction. Competition from new issues, notably this past week's re-issue of £15 million Dorman Long ordinary stock, is also making itself felt, while yesterday's by-election at West Derby was by no means an inconsiderable factor. In the electrical equipment market, the Lucas and Plessey results have been among the main events. S. Smith (England) advanced 1s on an increased dividend and excellent figures.

Lower Prices

The accompanying share lists reflect the general character of last week's retreat in the industrial market; and in some cases, the extent to which official quotations were marked down was a little flattering to conditions in the market. A.E.I. show a loss of 2s, and have been dealt in below 60s. G.E.C. fell back to 57s 6d. Babcock & Wilcox were 6s 6d down by the beginning of this week, and among shares to shed between 1s 6d and 2s 6d of previous rises were I.C.I., Reyrolles, Siemens, Pye, Henleys, Ever Ready and Allen West. Conspicuously, Enfield Cables moved against the trend, rising at one time from 23s 9d to 26s 3d. Thorn Electrical and Aberdare Cables also recorded some of the week's few improvements. Dictograph Telephones were a fraction over 7s; the company is maintaining the ordinary dividend at 20 per cent from increased earnings.

Lucas Dividend

Some irregularity developed in the £1 shares of J. Lucas (Industries) following the news of the increase in earnings and dividend, but after dropping back to 43s 9d, they began to show a harder tendency. They started this year at the equivalent of about 25s 9d. According to the preliminary figures, the net group surplus has expanded from £1·2 to £1·4 million, despite an enlargement of the tax charge by practically half a million to £5·4 million (which includes another heavy charge under the heading of the excess profits levy). This provides three-fold cover for the new rate of ordinary dividend, which, allowing for the intervening 100 per cent scrip issue, is being raised effectively from 5·4 to 7½ per cent on the present capital. After this increase, the yield on the shares is still in the neighbourhood of only 3½ per cent, which leaves no doubt

The Week's Price Changes

Company or Board	Nom. Value	Middle price 15th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	97		3	3	3 1 9	97	88⅝
Brit Elec. 1974/77	100	95½		3	3	3 2 9	96½	87½
Brit. Elec. 1976/79	100	101	+½	3½	3½	3 9 4	101½	93 15/16
Brit. Elec. 1974/79	100	111		4¼	4¼	3 16 6	111½	103 1/16
Overseas Electric Supply								
Calcutta Elec.	£1	21/6	−1/-	6†	6†	5 6 8†	24/6	18/7
East African Power	£1	23/-		7	7	6 1 9	23/4	19/6
Nigerian Elec.	£1	24/-		10	10	8 6 8	25/-	23/6
Palestine Elec. "A"	£1	21/-		Nil	Nil	—	21/-	16/-
Perak Hydro-Elec.	£1	17/6	−6d	6	10	11 8 4	20/-	13 9
Equipment and Manufacturing								
Aberdare Cables	5/-	14/3	+6d	25	12½*	4 7 9	14/3	8 1
Aerialite	1/-	14/6		88⅛	88⅛	6 1 9	14/6	10 9
Allen, W. H.	£1	77/-		15	20	5 4 0	77/-	50 -
Aron Elec. Ord.	£1	60/-		20	15	5 0 0	60/-	43 -
Assoc. Elec. Ord.	£1	60/6	−2/-	20	11½*	3 14 6	62/6	41/6
Automatic Tel. & El.	£1	70/9	−6d	15	15	—	73/-	57 3
Babcock & Wilcox	£1	68/9	−6/6	18	12*	3 9 9	76/3	47 3
Baldwin, H. J.	2/-	5/-		20	20	8 0 0	5/6	3 9
Bakelite	10/-	31/3	+6d	12½	12½	3 19 10	32/-	23 6
British Aluminium	£1	38/9	−1/-	12	10	5 3 0	40/-	33 9
B.I. Callender's	£1	51/6	−6d	10	10	3 17 9	52/-	37/9
B.I. Callender's 6% Pref. ...	£1	26/3		6	6	4 11 6	26/6	24/3
British Thermostat	5/-	27/-	−6d	35	27½*	—	28/-	12 -
British Vac. Cleaner	5/-	13/6		15	25	9 1 10	14/6	11/6
Brook Motors	10/-	45/6		20	20*	—	45/6	29 3
Brush Ord.	5/-	7/9	6d	4	6	3 17 3	8/3	3/6
Bulgin, A. F.	1/-	3/9		30	30	8 0 0	3/9	3/2
Burco	5/-	19/9		35	25*	6 6 7	19/9	12 1
Chloride El. Storage "A" ...	£1	67/-	−6d	20	12½*	3 12 8	68/6	46/6
Clarke Chapman	£1	67/-		17½	20	—	73/-	47/6
Cole, E. K.	5/-	18/-	−9d	25	27½	—	19/6	11/6
Cossor, A. C.	5/-	9/6	−3d	10	10	5 5 3	11/-	7 -
Crabtree	10/-	31/6	+1/6d	17½	20	6 7 0	32/-	23 9
Crompton Parkinson Ord. ...	5/-	18/9	−1/9	20	20	5 6 8	22 -	14 -
De La Rue	5/-	20/-	+9d	Nil	20	5 0 0	21 -	12 3
Decca	4/-	50/6	−9d	150	35*	—	51/3	32 -
Desoutter	5/-	25/-	+1/3	18	20	4 0 0	25 -	16 1
Dewhurst	2/-	7/-		19	19	5 8 6	7 -	5 1
Dictograph Tel.	2/-	7/-		20	20	6 3 0	8 -	5/2
Dubilier Condenser	1/-	4/4½		25	25	—	5/3	3 3
E.M.I.	10/-	19 9		12	8	4 1 0	23 -	11/3
Electrical Components	5/-	16/3		20	20	6 3 0	16/3	10 9
Elec. Construction	£1	68/9		15	15	4 7 3	68/9	53 -
Enfield Cable Ord.	£1	26/3	+2/6	5	Nil	Nil	26/3	16 6
English Electric	£1	52/6	−1/6	15	10*	3 16 6	59/-	38 -
English Electric 3½% Pref. ...	£1	16/9		3½	3½	4 9 7	16/9	15/3
Ericsson Tel.	5/-	31/3	−1/6	22†	25†	2 0 0†*	33/9	22/9
Ever Ready	5/-	24/6	−1/6	35	40	—	26/3	27/9
Falk Stadelmann	£1	42/6	+6d	15	15	7 1 2	42/6	36/6
G.E.C. Ord.	£1	57/6	−2/6	11½	12½	4 6 10	60 -	37/6
G.E.C. 6½% Pref.	£1	27/6		6½	6½	4 14 6	27/6	26/6
General Cables	5/-	17/9		30	30	8 9 0	18 -	16/3
Greenwood & Batley	£1	51/3		17½	17½	6 16 6	51/3	40/3
Hackbridge Cable	5/-	14/9		20	20	6 15 6	15/9	11/3
Hackbridge & Hewittic	5/-	25/-		20	25	5 0 0	25 -	16/10
Hall Tel. Acc.	10/-	12/-		10	10	8 6 8	13/-	10/6
Heatrae	2/-	5/6		12½	12½	4 11 0	5/6	4 -
Henley's	10/-	18/6	−2/-	10½	10½	5 13 6	22 -	15/6
Holophane	5/-	17/6		20	25	7 2 9	17/6	13 1

* After capital bonus. † Free of income tax.

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.

about the firmness of investment confidence in the further prospect.

De La Rue Interim

An interim dividend of 8 per cent declared by De La Rue, in respect of the year ending next March, seemed to carry no special implications regarding the total, but served all the same to maintain support for the 5s shares at around the £1 mark. The sharp rise of recent weeks has carried the quotation to the best level seen for about three years, during which time it has been as low as 5s 9d. For the last year, the company's earnings recovered most of the ground lost in the severe reverse of the previous period, and a single ordinary distribution of 20 per cent was made. This year's revival in the popularity of the shares is associated in the market with reports of better trading conditions for plastics, as well as for some of the group's relatively new interests.

in Electrical Investments

Company or Board	Nom. Value	Middle price 15th Nov.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1954 Highest	1954 Lowest
Equipment and Manufacturing—continued.						£ s d		
Hoover	5/-	43/-	−2/-	25	45	5 4 8	51/-	26/3
I.C.I.	£1	39/9	−2/-	13	15	3 16 2*	43/6	26/6
Intl. Combustion	5/-	27/-	−1/-	15	20	3 14 0	30/-	14/6
Johnson & Phillips	£1	47/-	−3d	15	15	6 7 9	52/6	47/-
Lancashire Dynamo	£1	56/3		12½	14	4 19 6	59/6	43/-
Laurence, Scott	5/-	26/3		15	20	3 17 3	26/6	14/-
Lister, R. A.	£1	32/6	−6d	9	12	—	33/-	22/6
London Elec. Wire	£1	53/9		15	10*	3 14 6	54/-	38/-
Lucas, J.	£1	43/9	−2/6	10·8	7½*	3 8 6	49/-	25/3
Marryat & Scott	2/-	8/3		22½	25	6 1 3	8/3	5/11
Mather & Platt	£1	51/-	−1/6	12½	15	—	53/-	32/-
Metal Industries	£1	33/9	−9d	12	9	5 6 6	42/3	29/6
Midland Elec. Mfg.	£1	75/-		15	15	4 0 0	75/-	63/-
Morphy-Richards	4/-	25/6		40	35*	5 9 10	26/-	11/4
Murex	£1	52/-		15	15	5 15 6	57/-	49/-
Newman Ind.	2/-	2/4½		10	10	8 8 5	2/6	2/-
Oldham & Son	1/-	3/-		17½	17½	5 16 8	3/4	2/5
Parnall (Yate)	5/-	10/-	−6d	6	8	4 0 0	11/-	4/3
Parsons, C. A.	£1	55/-		12½*	7½*	2 14 6	60/-	38/1
Plessey	10/-	57/-		30	20*	3 10 3	58/9	37/10
Pye Deferred	5/-	34/3	−2/6	20	20*	2 18 6	37/-	15/7
Revo	10/-	14/6		27½	9*	6 4 6	20/3	14/-
Reyrolle	£1	87/6	−2/6	12½	13⅜	3 2 10	92/6	66/-
Rheostatic	4/-	15/6	+6d	19	20	5 3 3	15/9	11/-
Richardsons Westgarth	5/-	11/3	−6d	15	15*	6 13 4	12/3	6/6
Scottish Cables	4/-	19/9		20	27½	5 11 3	21/9	12/1
Siemens Ord.	£1	34/-	−2/-	10	10	5 17 9	43/9	33/9
Smith (England), S.	4/-	15/6	+1/-	15	17½	4 10 0*	15/-	7/8
Southern Areas	£1	30/-	−1/3	6	7½	5 0 0	31/3	17/6
Strand Elec.	5/-	9/9		17½	17½	8 19 6	9/9	8/3
Sturtevant	5/-	22/9		18·1†	18·9*†	—	22/9	14/6
Sun. Elec.	£1	33/9		15	15	8 17 9	33/9	27/6
Switchgear & Cowans	5/-	12/-		22½	10	4 3 4	13/7	9/9
Taylor Tunnicliff	5/-	11/3	+3d	25	12½*	5 11 0	12/4	10/7
T.C.C.	10/-	38/9	+1/3	20	30*	—	38/9	21/3
T.C. & M.	£1	33/6		10	8½*	5 1 6	34/6	30/3
Telephone Mfg.	5/-	9/6		10	10	5 5 3	9/6	7/6
Thorn Elec.	5/-	29/6	+1/6	12½	20	3 7 9	29/6	13/3
Thornycroft	£1	48/-	−1/-	15	15	6 3 9	50/-	33/4
Tube Investments	£1	75/-	−1/3	15	17½	4 13 4	79/9	60/3
Vactric	5/-	18/-		Nil	10	2 15 6	18/9	7/6
Veritys	5/-	10/6	+6d	10	12½	5 19 0	10/6	5/-
Walsall Conduits	4/-	51/3		70	70	5 9 4	52/6	44/-
Ward & Goldstone	5/-	43/3	+9d	45	50	—	43/6	21/-
Watford	2/-	6/6		25	22½*	—	7/3	4/7
Westinghouse Brake	£1	82/6		15	16	3 17 8	83/-	60/9
West, Allen	5/-	18/-	−1/6	15	17½	4 17 3	19/6	12/7
Wolf Electric	5/-	17/6		15	17½	5 0 0	17/6	11/-
Trusts, Transport and Communications								
Anglo-Am Tel.:								
A Ord.	100	88		6	6	6 16 4	89½	80
Ord.	100	54½		3½	3⅝	6 17 6	55½	52
Anglo-Portuguese	£1	25/3		—	8	6 6 9	25/9	21/-
Brit. Elec. Traction:								
Def. Ord.	5/-	22/-xc	−4/-	35	50	—	24/-	13/-
Cable & Wireless:								
Ord.	£1	41/-	−1/-	8	9	4 7 10	49/6	26/2
4% Loan	100	98½		4	4½	4 1 3	98½	95½
Calcutta Trams	£1	21/6		2½†	6†	5 11 6†	24/6	17/1
Cape Elec. Trams	£1	15/6		5½	7	9 13 6	17/6	12/4
Marconi Marine	£1	32/6		10	10	6 3 0	35/-	27/6
Oriental Tel. Ord.	£1	96/3	−1/3	16	16	—	99/1	82/6
Telephone Props.	£1	92/6		—	—	—	92/6	74/6
Telephone Rentals	5/-	10/6		10	10	4 15 3	10/6	9/-

Plessey Results

The rate of the 10 per cent final dividend now declared by the Plessey Co. was forecast in May. At that time, the issued capital was raised to £800,000 as a result of the 100 per cent scrip issue and the " rights " issue of 600,000 new 10s ordinary shares at 30s each. The latter did not qualify for the 10 per cent interim dividend for the year ended last June. After the latest announcement, the price of the shares was 55s 9d in the market. (At the time of last year's results, the corresponding figure was in the neighbourhood of 30s.) The yield now works out at under 3⅞ per cent on the 20 per cent total distribution, which, however, is covered more than four times by the year's increased net surplus of £473,000 after tax. Excess profits levy at £90,000 again takes almost as much as the net ordinary dividend, and will of course disappear from future accounts.

British Electric Resistance

The 2s shares of the British Electric Resistance Co. show little net change, at around 4s 3d, since the declaration of a final dividend, making a total of 20 per cent for the year ended in July. This follows a share-for-share capitalization issue, and represents, in effect, an advance of 8½ per cent over the previous distribution. The payment absorbs £11,000 net from the increased profit of £15,700 after tax. There is an accompanying statement from the company to the effect that the reserves built up as a result of past profit retentions are now sufficient for all immediate purposes, and that, with trading conditions more stable now than for some time past, it is justifiable for shareholders to receive increased dividend benefits.

Preference Shares

Preference stocks recently on offer in fair numbers include Crompton Parkinson 6 per cent (second) at 26s 9d, and the same company's 8 per cents at 33s 9d, the yields being respectively 4½ and 4⅞ per cent. Returns of around 4½ per cent are available from Ferranti 5 per cent second preference at 22s 9d, G.E.C. 4¼ per cents at 19s 3d, Telephone Rentals 4½ per cents at 19s 9d and Telegraph Construction " fives " at 23s. Marryat & Scott 6 per cents have been on offer at 22s 3d to yield 5·4 per cent.

REPORTS and DIVIDENDS

Tube Investments, Ltd.—The annual meeting will be held on 8th December. In his circulated statement, Sir Ivan A. R. Stedeford (chairman) says that good progress has been made towards bringing the new rolling mills in South Wales to a state of operational efficiency and the last phase of plant development there is nearing completion. This includes the transfer of the hand-operated mills from Reynolds Rolling Mills, Oldbury. Demand for extruded products and tubes has been well maintained and additional capacity for these is planned at the works at Redditch. During the year the outside interests in Reynolds Rolling Mills and the South Wales Aluminium Co., Ltd., have been acquired and these two companies have become wholly-owned subsidiaries.

With adequate supplies of electricity available sales of Creda electric cookers and water heaters were more than doubled during the year. Competition in industrial electrical equipment has intensified but the volume of sales has been maintained. The ranges of switch and fuse gear and switch assemblies have been extended and trade in plastic covered electric cables has justified plans for increasing the productive capacity.

Although the Mersey Cable Works is not a member of the C.M.A. it has suffered from a confusion which has prevailed in the industry following the report of the Monopolies Commission and which has led to severe price cutting. The company has maintained its volume of sales but it ended the year with a trading result well below any reasonable expectation.

After referring to the activities of associated companies overseas, the chairman says that the group's direct exports represented a slight increase in value on the previous year. It is estimated that in volume exports closely approached those of two years ago when the record figure of over £20 million was achieved. As in previous years the Commonwealth took the major share of overseas shipments, but further efforts to establish a good trade with the dollar world yielded satisfactory sales. Dispatches to the United States and Canada were increased by over 50 per cent and 30 per cent respectively.

Scottish Cables (South Africa), Ltd.—The main figures in the accounts were given in our issue of 1st October. In his circulated statement Mr. W. Fraser (chairman) said that in the year under review they encountered serious trading difficulties, the reasons being principally the withholding of the placing of orders due to the unsettled state of the copper market, the general economic position affecting monetary conditions in South Africa, and severe competition. There were now signs of a return to more stabilized conditions. The order books were in a much healthier position than they were at the close of the year. This applied particularly to the heavier power distribution cables which were particularly affected by the recession which set in last year.

The Electrical Apparatus Co., Ltd., reports a consolidated trading profit for the year ended 31st July last of £316,462, as compared with £193,355 for the preceding year, to which is added other income making £322,843. After meeting all charges, including £166,619 for taxation, there is a net profit of £130,487 (against £74,493). The net balance of the parent company is £126,064 (£72,414). It is proposed to place £57,178 to general reserve and to pay a final ordinary dividend of 15 per cent., making 22½ per cent for the year (against 20 per cent). The balance carried forward is £137,904 (against £103,228 brought in).

As reported in our issue of 22nd October, it is proposed to put forward proposals in the new year for amalgamating the present two classes of preference shares into one class by converting the 10 per cent "A" shares into 8 per cent shares and giving the holders of the "A" shares one extra share for each four held. It is also proposed to issue new 5s ordinary shares, credited as fully paid, to ordinary shareholders in the proportion of one new share for every eight shares held. This does not mean that the total sum paid as ordinary dividends will be increased.

In his circulated statement, Mr. R. H. Barbour (chairman) says that there is much emphasis nowadays on centralized control of industrial processes and in recent times they have been entrusted with many important contracts in connection with air conditioning, pumping, and mechanical equipment. The completion of two new workshop bays is enabling them to devote special attention to this more complicated cubicle type gear. The level of exports is increasing.

S. Smith & Sons (England), Ltd.—The group profits for the year to 31st July last amounted to £2,853,609, as compared with £2,125,725 for the previous year. Provision for taxation is £1,707,479 and the net profit is £1,130,068 (against £633,603). The net profit of the parent company is £478,201 (£411,201). It is proposed to pay a final dividend of 12½ per cent, making 17½ per cent for the year on capital increased by a scrip issue of three in five and the Kelvin & Hughes acquisition. This compares with 15 per cent for 1952–53 on the smaller capital.

The British Electric Resistance Co., Ltd.—After providing £29,664 for taxation, the net profit for the year to 31st July is £15,736, as compared with £14,056 for 1952–53. General reserve receives £4,000, and it is proposed to pay a final dividend of 17½ per cent, making 20 per cent for the year on doubled capital. For the previous year the distribution was 25 per cent on smaller capital. The balance carried forward is £9,675 (against £9,614 brought in).

Joseph Lucas (Industries), Ltd.—The consolidated surplus for the year to 31st July last, after deducting taxation, is £1,451,498, as compared with £1,217,149 for 1952–53. Taxation amounted to £5,460,127. It is proposed to pay a final ordinary dividend of 1s 3d per £1 share, making the equivalent of 1s 6d per share for the year on capital doubled by a scrip issue. Last year's dividends totalled 2s 2d, equivalent to 1s 1d on the present capital. The net profit of the parent company amounted to £1,167,431 (against £819,861).

The Plessey Co., Ltd.—The trading profit for the year ended 30th June last amounted to £1,059,206, as compared with £819,519 for the previous year, to which is added interest on tax certificates, etc. (£4,396), and adjustments of profits for previous years (£62,108), making a total of £1,125,710. Taxation absorbs £652,226 and the net profit is £473,484 (against £327,036). General reserve receives £207,160, and it is proposed to pay a final ordinary dividend of 10 per cent making 20 per cent on £500,000 and 10 per cent final only on £300,000 (in issue for six months). For the previous year the total distribution was 30 per cent on £250,000. The balance carried forward is £618,301 (against £450,097 brought in).

Johnson & Phillips, Ltd., have declared an interim dividend of 7½ per cent (same).

Richard Johnson & Nephew, Ltd., are paying an unchanged interim dividend of 2 per cent.

Thomas De La Rue & Co., Ltd., is resuming interim dividends with a payment of 8 per cent. Last year a single payment of 20 per cent was made.

The Telephone Manufacturing Co., Ltd., has declared an interim dividend of 2½ per cent (unchanged).

New Companies

Ambrex Electrics, Ltd.—Registered 3rd November. Capital £100. Electrical engineers and contractors, manufacturers of and dealers in radio and television apparatus, etc. The first directors are to be appointed by the subscribers. Secretary: T. A. Herbert, 156, Strand, W.C.2.

Thomas Ness (Radio), Ltd.—Registered in Edinburgh 15th October. Capital £5,000. Manufacturers, servicers and distributors of electrical and sound vision apparatus, etc. Directors: T. Ness, R. A. Hogg and Mrs. Q. Ness. Secretary: Mrs. Eliz. Hogg. Registered office: 244, Kilbourie Road, Clydebank.

Speed Electric Service (Stoke-on-Trent), Ltd.—Private company. Registered 20th October. Capital £3,000. Electrical, wireless, telephone, lighting, heating, motor, mechanical and general engineers, etc. Permanent directors: D. F. Goring, Lilian M. Goring and Mrs. P. A. Shaw. Secretary: Patricia A. Shaw. Regd. office: 26, Hillchurch Street, Hanley, Stoke-on-Trent.

Springhill (Electrical Maintenance), Ltd. — Registered 2nd November. Capital £1,000. Electrical plant maintenance engineers, electrical appliance manufacturers and repairers, etc. Directors: J. W. Hindle and June C. Hindle. Regd. office: Ackroyd Mill, Cornholme, nr. Todmorden.

Bankruptcies

F. J. Crutchley, trading as Frank Crutchley at 9, York Street, Hulme, Manchester, electrical engineer.—Application for discharge to be heard on 13th December at the Court House, Quay Street, Manchester.

H. Turner, 20, Battersea Rise, Clapham Common, London, radio and electrical contractor.—Application for discharge to be heard on 8th December at the Court House, Garratt Lane, Wandsworth, S.W.18.

A. Jager, late of 64, Cholmley Gardens, N.W.6, and 408, Edgware Road, London, W.2, present address unknown, electrical engineer.—Trustee, Mr. P. Phillips, 76, New Cavendish Street, London, W.1, appointed 28th October.

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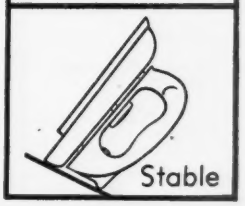

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NEXT WEEK'S EVENTS

Organizers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 231, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

Monday, 22nd November

BIRMINGHAM.—James Watt Institute, Great Charles Street, 6 p.m. I.E.E. South Midland Radio Group. "Loud-speaker Systems—Recent Trends in Design," by Major A. E. Falkus.

BOURNEMOUTH.—Grand Hotel, 8.15 p.m. A.S.E.E. Bournemouth Branch. "Electrics in the Modern Aircraft," by C. J. Foote.

BRISTOL.—Electricity House, Colston Avenue, 6 p.m. I.E.E. Western Utilization Group. "Electrical Planning for a Modern Cigarette Factory," by J. M. Druce and R. H. Cobbold.

BURTON-ON-TRENT.—Technical College, Manor Croft, 7.15 p.m. Ministry of Works. "Latest Techniques for Electrical Installations in Small Buildings," by C. E. Bedford.

LEEDS.—24, Aire Street, 6.15 p.m. I.E.S. Leeds Centre. "New Lamps, New Uses and New Lighting Techniques," by R. V. Mills.

LEICESTER.—E.M.E.B., Charles Street, 6 p.m. I.E.S. Leicester Centre. "The History and Development of Lighting," by L. H. Hubble.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Radio Section. "Plastics for the Radio Engineer," by M. Jones.

NEWCASTLE-UPON-TYNE.—Neville Hall, Westgate Road, 6.15 p.m. I.E.E. North-Eastern Centre. "Service Experience of the Effect of Corrosion on Steel-Cored-Aluminium Overhead-Line Conductors," by Dr. J. S. Forrest and J. M. Ward.

STAFFORD.—Technical College, 7 p.m. I.E.E. North Staffordshire Sub-Centre. "Short Circuit Forces on Turbo-Alternator End Windings," by J. B. Young and D. H. Tompsett, and "The Electrical Measurement of Steam Turbine Rotor Movements, with special reference to the Operation and Design of Modern Plant," by J. L. Ashworth, J. S. Hall and A. H. Gray.

Tuesday, 23rd November

COVENTRY.—Electricity Sports and Social Club, Merrick Lodge, St. Nicholas Street. Coventry Electric Club. "Germicidal Radiation," by D. H. Holloway.

LEEDS.—1, Whitehall Road, 6.30 p.m. I.E.E. North Midland Utilization Group. "Electric Lifts in Post-War Housing," by C. G. L. Morley.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurements Section. "The Application of the Hall Effect in a Semi-Conductor to the Measurement of Power in an Electromagnetic Field," by Prof. H. E. M. Barlow. "Audio-Frequency Power Measurements by Dynamometer Wattmeters," by Dr. A. H. M. Arnold.

Savoy Place, W.C.2, 6.30 p.m. I.E.E. London Students' Section. Students' Lecture: "Attitudes of Mind," by A. R. Cooper.

At the Lighting Service Bureau, 2, Savoy Hill, W.C.2, 6 p.m. Illuminating Engineering Society. "Light and Crime Detection," by C. H. Edlin.

MANCHESTER.—Engineers' Club, Albert Square, 6.15 p.m. I.E.E. North-Western Measurements Group. "Magnetic Measurement of Mechanical Hardness," by D. Hadfield, and "Determination of the Static and Dynamic Elastic Properties of Resilient Materials," by R. S. Jackson, Dr. A. J. King and C. R. Maguire.

NOTTINGHAM.—Gas Board's Demonstration Theatre, 6.30 p.m. I.E.E. East Midland Centre. "Telemetering for System Operation," by R. H. Dunn and C. H. Chambers.

Wednesday, 24th November

BIRMINGHAM.—At the G.E.C. Witton. Institute of Industrial Supervisors, Birmingham Section. Afternoon visit. "The Uskmouth Project," by Mr. Lang.

BOURNEMOUTH.—Grand Hotel, 6.30 p.m. I.E.E. Southern Centre, district meeting. "The Possibilities of a Cross Channel Power Link between the British and French Supply Systems," by D. P. Sayers, M. Laborde and F. J. Lane.

COVENTRY.—At the G.E.C. Radio Works, 7 p.m. I.E.E. South Midland Students' Section. "Electronics in Organs," by W. A. Torbell.

LONDON.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Supply Section. "Supervisory Equipment for the Indication of Shaft Distortion in Steam Turbines," by D. Antrich, H. W. B. Gardiner and R. K. Hilton. "The Electrical Measurement of Steam-Turbine Rotor Movements, with special reference to the Operation and Design of Modern Power Plant," by J. L. Ashworth, J. S. Hall and A. H. Gray.

Connaught Rooms, 12.30 for 12.55 p.m. Batti-Wallahs' Society. Monthly luncheon. Speaker, Air Chief Marshal Sir Arthur Longmore.

Trocadero Restaurant, W.1, 12.30 for 1 p.m. Electrical Fair Trading Council. Twenty-first anniversary luncheon.

Waterloo Bridge House, 5 p.m. Institution of Post Office Electrical Engineers, London Centre. Informal meeting. "Some Personal Views on the Mechanization of Auto Exchange Maintenance," by F. H. Horner and B. H. E. Rogers.

School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, 6.30 p.m. British Institution of Radio Engineers, London Section. "The Development and Design of Direct-coupled Oscilloscopes for Industry and Research," by M. J. Goddard.

MIDDLESBROUGH.—Cleveland Scientific and Technical Institute, Corporation Road, 6.30 p.m. I.E.E. North-Eastern Students' Section, Tees-Side meeting. Film show.

NORTHAMPTON.—College of Technology, 7 p.m. I.E.E. Rugby Students' Section. "Power Factor Correction and Control," by F. E. H. King and P. G. Urry.

SALFORD.—Telephone House, Chapel Street, 6.45 p.m. I.E.E. North-Western Radio Group. "The Manchester–Kirk o'Shotts Television Radio Relay System," by C. Dawson, L. L. Hall, K. G. Hodgson, R. A. Meers and J. H. H. Merriman.

Wednesday, 24th November, to Saturday, 27th November

LONDON.—Royal Hotel, Woburn Place, W.C.2. Radio Society of Great Britain. Annual amateur radio exhibition.

Thursday, 25th November

BIRMINGHAM.—Regent House, St. Philip's Place, Colmore Row, 6 p.m. I.E.S. Birmingham Centre. "Gemology," by F. Hessling.

BRISTOL.—Electricity House, Colston Avenue, 7 p.m. I.E.E. Bristol Students' Section. "The Operation and Routine Testing of Vision Transmitters," by A. Brown.

Electricity House, Colston Avenue, 7.15 p.m. E.P.E.A. South Western Technical Group. "Fuse Design," by K. Dannenberg.

GLASGOW.—At the Institution of Engineers and Shipbuilders, Elmbank Crescent, 7.30 p.m. I.E.E. South-West Scotland Students' Section. "Valve Stabilized Power Supplies," by J. Irvine.

GREAT MALVERN.—Winter Gardens Restaurant, 7.15 p.m. I.E.E. South-Midland Centre, district meeting. "Colour Television," by C. J. Hirsch.

KETTERING.—George Hotel, 7.30 p.m. I.E.E. East Midland Centre, district meeting. "Safety in the Use of Portable and Transportable Electrical Equipment in Industry," by J. W. Bunting.

LONDON.—At the Institution of Civil Engineers, Great George Street, 5.30 p.m. Institute of Fuel. "Peat-fired Power Stations," by W. Cronin and J. F. Lang.

SOUTHSEA.—South Parade Pier Pavilion. E.I.B.A. Hants and Dorset Branch. Annual ball.

TAUNTON.—Electricity Offices, 3 p.m. I.E.E. South-Western Sub-Centre. "Fluorescent Discharge-Tube Circuits and Operating Problems," by J. Cates.

Friday, 26th November

BATH.—S.W.E.B., Old Bridge Street, 7 p.m. I.E.S. Bath and Bristol Centre. "Lighting for Enjoyment," by T. O. Freeth.

LEICESTER.—College of Technology, 7.0 p.m. I.E.E. East Midland Centre. Joint meeting with Leicester Association of Engineers. "A Radio Position Fixing System for Ships and Aircraft," by C. Powell.

LONDON.—Connaught Rooms, W.C.2. Electrical Power Engineers' Association. 5.30 for 6 p.m. Annual dinner.

Pepys House, 14, Rochester Row, 7 p.m. Junior Institution of Engineers. Annual general meeting.

MANCHESTER.—Engineers' Club, Albert Square, 6.45 p.m. Manchester Association of Engineers. "Submarine Telegraph and Telephone Cables," by F. Mattingley.

NEWCASTLE-UPON-TYNE.—At the Mining Institute, 6.15 p.m. North East Coast Institution of Engineers and Shipbuilders. "The Use of a Digital Computer with particular reference to the Analysis of Structures," by Dr. R. K. Livesley and T. M. Charlton.

PETERBOROUGH.—Dujon Café, Market Place. Incorporated Plant Engineers, Peterborough Branch. Annual dinner.

STONE.—Crown Hotel, 8.30 p.m. I.E.E. North Staffordshire Sub-Centre. Annual dance.

WEYMOUTH.—Technical College, 6.30 p.m. I.E.E. Southern Centre. "Electric Fuses and Circuit Breakers," by E. W. Baxter.

Saturday, 27th November

LONDON.—I.E.E. London Students' Section. Visit to X-ray Department (Diagnostic), St. Bartholomew's Hospital, at 10 a.m.

TRADE MARKS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 3rd December:—

STANDEE. No. 723,361, Class 9. Electric resistances.—Clarostat Mfg. Co., Inc., Dover, New Hampshire, U.S.A. Address for service, c/o Marks & Clerk, 57–58, Lincoln's Inn Fields, London, W.C.2.

PLASTI-GRIP (design). No. 729,008, Class 9. Electric terminals.—Aircraft-Marine Products, Inc., Harrisburg, Penn., U.S.A. Address for service, c/o Stevens, Langner, Parry & Rollinson, 5–9, Quality Court, Chancery Lane, London, W.C.2.

FORMATROL. No. 729,269, Class 9. Electric apparatus for regulating the operation and speed of electrical machinery by means of current voltage or phase control.—Prosperity Co., Inc., Syracuse, N.Y., U.S.A. Address for service, c/o Gill, Jennings & Every, 51–52, Chancery Lane, London, W.C.2.

FERROPULSER. No. 732,931. FERROTUTOR. No. 732,932, Class 9. Apparatus for recording, reproducing and amplifying electric oscillations, and parts.—Wright & Weaire, Ltd., 131, Sloane Street, London, S.W.1.

FLEUR-DE-LIS. No. 733,388, Class 10. Electrically heated blankets.—Thomas French & Sons, Ltd., Chester Road Mills, Chester Road, Manchester, 15.

LIVIA. No. B732,634, Class 11. Electric lamp bulbs, electric torches and electric hand lamps and parts.—S. D. Sullam, Ltd., Africa House, Kingsway, London, W.C.2.

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (2s 8d each including postage) will be obtainable after 22nd December from the Patent Office, 25, Southampton Buildings, London, W.C.2.

1950

16848. Elektro-Mechanik-Ges. — Electro-hydraulic actuating device. 5th July, 1950. (720462.)

1951

7937. English Electric Co., Ltd.—Electro-hydraulic devices. 28th March, 1952. (720468.)

10643. Ames, W. A. B.—Electromagnetic switch devices. 16th March, 1953. (720393.)

18749. Libbey-Owens-Ford Glass Co.—Electrically conducting laminated safety glass. 9th August, 1951. (720539.)

19470. Siemens-Reiniger-Werke Akt.-Ges.—Electric high vacuum discharge tubes. 17th August, 1951. (720540.)

19503. Electric & Musical Industries, Ltd.—Cathode ray tubes. 12th August, 1952. (720541.)

22266. Hotpoint Electric Appliance Co., Ltd.—Ventilating fans. 8th August, 1952. (720542.)

20964. British Thomson-Houston Co., Ltd.—Electric pulse generating circuits. 1st July, 1952. (720544.)

25878. Wollenhaupt, J., and Maecker, K.—Electrically driven feed mechanism for machine tools. 5th November, 1951. (720478.)

28907. Twentieth Century Electronics, Ltd., and Balaam, N. B.—Ionization tubes. 10th December, 1952. (720550.)

29747. Philco Corporation.—Colour television transmitting system. 19th December, 1951. (720552.)

1952

909. Philco Corporation. — Colour television apparatus. 11th January, 1952. (720554.)

1406. General Electric Co., Ltd., and Warren, G. W.—Cathode ray tubes. 19th January, 1953. (720599.)

1511. British Dielectric Research, Ltd.—Manufacture of electrical insulating material in sheet form analogous to paper. 16th January, 1953. (720555.)

3335/6. Automatic Telephone & Electric Co., Ltd.—Telephone systems. 27th January, 1953. (720484/5.)

4562. Dunlop Rubber Co., Ltd.—Electric resistance elements. 16th January, 1953. (720602.)

7661. British Insulated Callender's Cables, Ltd.—Method of detecting leaks. 24th March, 1953. (720497.)

7789. Marx, E.—Manufacturing terminals and fitting them to electric wires. 2nd September, 1952. (720604.)

9732. Radio Corporation of America.—Electrode assemblies for electron tubes. 17th April, 1952. (720606.)

10436. Kilford, W. R.—Holding devices for the sheaths or conduits of electric cables and wires. 27th February, 1953. (720608.)

13361. General Motors Corporation.—Electrical discharge systems. 27th May, 1952. (720418.)

14503. British Vacuum Cleaner & Engineering Co., Ltd.—Vacuum cleaning apparatus. 4th June, 1953. (720421.)

15219. Philips Electrical Industries, Ltd.—Methods of applying a luminescent layer to the hollow side of a support having a rotation-symmetrical curved surface. 17th June, 1952. (720621.)

16113 and 16246. British Thomson-Houston Co., Ltd.—Manufacture of electric lamps. 26th June, 1952. (720422/3.)

16258. Standard Telephones and Cables, Ltd.—Electrical contact spring mountings. 27th June, 1952. (720624.)

16288. General Electric Co.—Soldering. 27th June, 1952. (720424.)

16401. British Thomson-Houston Co., Ltd.—Defective lamp detecting and ejecting mechanism. 30th June, 1952. (720425.)

16402. British Thomson-Houston Co., Ltd.—Manufacture of electric lamps. 30th June, 1952. (720426.)

16738. Dittgen, J. K.—Electrically heated vessel. 2nd July, 1953. (720625.)

20274. British Dielectric Research, Ltd.—Electric capacitor. 12th August, 1953. (720514.)

20385. Evershed & Vignoles, Ltd.—Electrically operated devices for indicating and measuring the level of liquids. 13th August, 1953. (720515.)

22149. Lucas (Industries), Ltd., J.—Electromagnetically operated sound producing horns. 1st September, 1953. (720635.)

22171. Westinghouse Electric International Co.—Dynamo electric machines. 3rd September, 1952. (720521.)

22251. Chance Bros., Ltd.—Rotary electric switches. 12th August, 1953. (720636.)

22392. Standard Telephones & Cables, Ltd.—Equipment for the capacitive or complex balancing of telecommunication cables. 5th September, 1952. (720572.)

22400. Philips Electrical Industries, Ltd.—Unipolar X-ray tubes. 5th September, 1952. (720574.)

25812. Lucas (Industries), Ltd., J.—Control means for electric engine starting motors. 2nd October, 1953. (720643.)

26912. Alden, M. Recording apparatus, more particularly for facsimile telegraphy. 27th October, 1952. (720446.)

27475. Pirelli-General Cable Works, Ltd., and Penrose, J. R.—Sheathed electric cables. 30th October, 1953. (720650.)

29938. Westinghouse Brake & Signal Co., Ltd., Simmons, A. W., and Kershaw, J. W. G.—Electro-pneumatic braking systems for railway vehicles and the like. 14th September, 1953. (720449.)

30216. Philips Electrical Industries, Ltd.—Electrical through connecting devices. 28th November, 1952. (720450.)

1953

3164. Philips Electrical Industries, Ltd.—Permanent magnet electron lenses. 4th February, 1953. (720662.)

3579. General Electric Co.—Control systems for dynamo electric machines. 9th February, 1953. (720683.)

3675. Westinghouse Electric International Co.—Coil winding machines. 10th February, 1953. (720685.)

3962. Singer Manufacturing Co.—Dynamo electric machines. 12th February, 1953. (720698.)

3981. Philips Electrical Industries, Ltd.—Systems and circuit arrangements for radio transmission of intelligence between a main station and a plurality of substations. 12th February, 1953. (720699.)

4102. Standard Telephones & Cables, Ltd.—Electric wave generator circuits. 13th February, 1953. (720706.)

4540. Philips Electrical Industries, Ltd.—Amplifiers having negative feed-back. 18th February, 1953. (720726.)

4557. General Electric Co.—Magnetic amplifier circuits. 18th February, 1953. (720727.)

4789. Standard Telephones & Cables, Ltd.—High frequency electric transformers. 20th February, 1953. (720731.)

5264. Philips Electrical Industries, Ltd.—Circuits for separating two pulsatory signals. 25th February, 1953. (720739.)

Amended Specification

602492. Fisk, Sir E. T.—Methods of making electrically connecting patterns, such as wiring circuits, coils and the like.

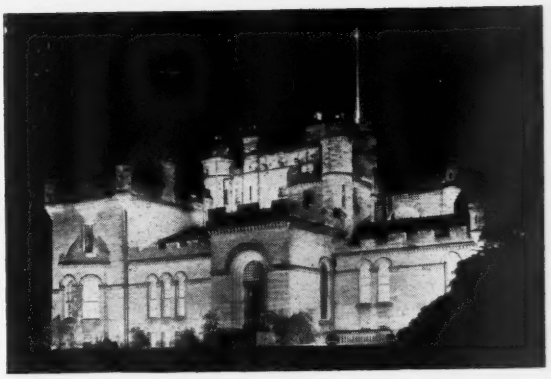
EGYPTIAN IMPORTS

EGYPTIAN imports of electrical machinery and apparatus in 1953 totalled £E7,741,000 in value, a drop of £E1,274,000 on 1952. The decline covered practically all lines and was particularly noticeable in power plant and radio sets. Such details of countries of origin as are available show that British trade decreased substantially. Half the imports of lamps came from the Netherlands and the remainder from four other supplying countries.

Class of Goods	1953 £E (000)	Inc. or dec. on 1952 £E (000)
Generators, motors and transformers	558	— 435
From Britain	145	— 58
,, *Belgium*	31	— 42
,, *Switzerland*	37	— 18
Elec. locos	9	— 82
Accumulators and parts	277	— 91
From Britain	61	— 27
,, *U.S.A.*	7	+ 4
Batteries, not pocket, and parts	282	— 5
Pocket batteries	32	— 2
Radio valves, transmitting	1	— 1
Ditto, receiving	128	— 84
Electro-medical apparatus	50	— 75
Electric lamps up to 40 W	67	+ 7
Ditto, 40 to 100 W	12	— 9
Ditto, over 100 W	16	— 9
Telegraph and telephone apparatus and parts	576	— 156
From Britain	164	— 48

Class of Goods	1953 £E (000)	Inc. or dec. on 1952 £E (000)
Radio receiving sets	709	— 367
From Britain	33	— 277
,, *U.S.A.*	9	— 20
,, *Netherlands*	197	— 246
Radio transmitting sets	5	— 6
Radiogramophones	24	— 20
Radio components for receiving sets	86	— 21
Ditto, transmission sets	3	— 13
Other radio components	227	+ 96
Irons	18	+ 5
Insulated tubes, metal-covered	23	— 22
Signalling apparatus	19	+ 3
Refrigerators, household	200	— 155
Other domestic apparatus	144	— 50
Cable, insulated, submarine and underground	1,411	— 42
Wire and cable, electric, unspecified and parts	365	— 42
Magnetos, etc.	78	— 30
Fans	45	+ 7

GENERATION AND DEVELOPMENT



The South East Scotland Electricity Board was responsible for the floodlighting of Oxenfoord Castle, Midlothian, on the occasion of the golden wedding anniversary of Lord and Lady Stair

£250,000 Rural Programme

Nearly £250,000 is being devoted to the development of electricity supplies in the rural areas of Gloucestershire during the current financial year. This was stated by the chairman of the Midlands Electricity Board, Mr. Walter S. Lewis, last week at the opening by the Mayor of Cheltenham (Councillor A. W. Mann) of a three-day exhibition arranged by the M.E.B. to demonstrate to representatives of local authorities, architects, builders and others the contribution that the electricity supply industry can make to the solution of housing and other problems.

Mr. Lewis said that of the estimated 2,530 farms of ten acres or more in the Board's Central Gloucestershire Sub-Area more than 1,800, or 71 per cent, were now on supply, compared with 1,100 in March, 1950

Referring to the cost of electricity, Mr. Lewis said that the Board was rather proud of the way it had kept tariffs down. The average price per kWh sold in the Sub-Area last year was 1·34d, which was virtually the same as the average price paid in 1948, although in the same period coal prices had gone up by more than 50 per cent.

Defining a Kitchen

The question of what exactly constituted a kitchen was the main issue in an appeal brought at the Londonderry Recorder's Court recently. Mr. M. F. Durey appealed against a conviction and fine of one shilling imposed at the petty sessions for refusal to admit an official of the Londonderry Electricity Department to his house to disconnect the electricity supply as defendant had failed to pay an additional charge of 3s 6d per quarter under the Corporation's room charge electricity rate.

The appeal was dismissed by Judge Copeland. The decision affects 875 other tenants on the Creggan estate who had also refused to pay this additional charge.

The appellant's case was that a 6ft square apartment was a scullery and not a kitchen and should not be subject to the additional charge. It was submitted for the Corporation that the apartment in question could be properly regarded as a kitchen.

Assisted Wiring

The Metropolitan Boroughs Standing Joint Committee has asked the London Electricity Board to reconsider its decision not to introduce an assisted wiring scheme and has approached the Minister of Housing and Local Government for his support. Copies of the correspondence between the Board and the Committee are being sent to the Ministry of Fuel and Power for consideration by the committee of inquiry into the electricity supply industry.

The matter first arose earlier this year when the Standing Joint Committee asked the Board for the early introduction of an assisted wiring scheme on the lines of those formerly operated by municipal electricity undertakings in London. The matter had been referred to the Committee by Stoke Newington Council, which expressed concern at the number of cases of defective wiring reported. In the absence of any agreement relating to repairs, there was no legal liability to compel the landlord or tenant to repair the wiring and in cases of hardship the National Assistance Board was unable to assist.

The Board replied that the responsibility for replacing defective wiring should rest with the landlord or tenant who, if necessary, should take advantage of the financial or other facilities made available to them by statute. The Board was carrying out a certain amount of wiring work under schemes in force at vesting date, but its limited capital expenditure allocation did not permit of the extension of such schemes. Moreover the Board could not ignore the fact that any wiring maintenance scheme had either to be self-supporting, in which case it would not be likely to appeal to customers with relatively small installations, or must be financed at the expense of the general body of consumers. The Board did not feel that this could be justified.

This reply was not considered satisfactory by the Committee, which stated that in the majority of cases the cost of replacement or renewing wiring would not qualify for an improvement grant. Hardship to the consumer should be avoided by the introduction of an assisted wiring scheme which should be financially self-supporting.

Staythorpe Cooling Towers

Southwell R.D.C. has appointed consulting engineers to investigate the necessity for the proposed cooling towers at Staythorpe generating station. The County Planning Committee has accordingly deferred consideration of the B.E.A.'s formal application in connection with the extension of the station.

Supergrid Route Inquiry

An inquiry was held at Bolton from 2nd to 4th November into objections to the proposed route of the British Electricity Authority's 275 kV transmission line in the area. The main question was whether the line should pass to the east or west of Bolton and Darwen. The B.E.A.'s case was that it was better for the line to cross open country than residential districts. It was further claimed that the alternative route to the east proposed by Bolton Corporation, the Lancashire County Council and the Lancashire Branch of the Council for the Preservation of Rural England would add £70,000 to the construction cost of about £1,350,000 and some £1,100 a year to the cost of maintenance. For the County Council it was stated that the proposed line would encroach for 8½ miles on land described in the county development plan as "of great landscape, scientific or historic value." An alternative route would encroach for only 3½ miles and would be only half a mile longer.

Cost of Power in Australia

The New South Wales Minister for Local Government (Mr. Renshaw) is confident that electricity charges in the State will be reduced by about £3 million within the next few years. He recently gave such an assurance in the Legislative Assembly, saying that this year the Electricity Commission had reduced its charges by £750,000. This followed a statement in the Tariff Board's annual report that the high cost of power was a serious handicap to industry. In some States, the report said, the charges had increased to such an extent as to constitute a major reason for the inability of industries to compete with their counterparts overseas. The present cost of power in Australia was approximately double that in the United Kingdom and treble the cost in the United States.

Canadian $25 Million Scheme

The B.C. Electric Co. is planning a $25 million hydro-power project in the Coast Mountains north of Vancouver, which will add some 190,000 h.p. to the company's plant capacity. It is planned to build a 2,000ft long dam on the Cheakamus River, a seven-mile tunnel and a remotely-controlled power-house. Mr. D. Grauer said recently that work would start as soon as the Government granted a licence and would take 32 months.

Plant for Johannesburg

The journal *South Africa* reports that Mr. J. C. Fraser, general manager of the Johannesburg Electricity Department and the City Treasurer, Dr. I. Q. Holmes, have been discussing with the city's engineering consultants here the placing of contracts to the value of about £5 million. These include three 30 MW sets, etc., for the Kelvin "A" power station.

Telephones in El Salvador

The *Fortnightly Review* of the Bank of London and South America reports that the Ministry of the Interior, El Salvador, which controls the automatic telephone service in San Salvador is studying a proposal to add 10,000 lines to the system. No contract has yet been arranged but it is believed that the work would cost 8 million colones (about £1·1 million).

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses.

Australia.—29th November. Electricity Commission of New South Wales, Sydney. 66 kV outdoor-type arc suppression coils. (E.S.B. 26151/54. Ten/11361.)* 6th December. Two 45 MVA transformers. (E.S.B. 26415/54. Ten/11406.)*

6th December. Melbourne City Council. L.v. air break circuit breakers and current transformers. (E.S.B. 26119/54. Ten/11390.)* Oil switch units for city substations. (E.S.B. 26120/54. Ten/11391.)*

Bangor (Co. Down).—30th November. Northern Ireland Housing Trust. Electrical installations in 247 houses. Offices of the Trust, 12, Hope Street, Belfast.

Birmingham.—13th December. Birmingham, Tame and Rea District Drainage Board. Electrical equipment at Minworth works. (See this issue.)

Colchester.—29th November. Corporation. Street lighting equipment. (See this issue.)

Dorchester.—23rd December. Corporation. Street lighting equipment. (See this issue.)

Edinburgh.—North of Scotland Hydro-Electric Board. Cabling, electric lighting, heating and other subsidiary services at Quoich and Invergarry generating stations. (See this issue.) Medium voltage switchgear and ancillary equipment for Cluanie Dam compensation and Loyne tunnel water generating station. (See this issue.)

Egypt.—7th December. Cairo Electricity and Gas Administration Fourteen 1,500 kVA transformers. (E.S.B. 26146/54. Ten/11365.)*

11th December. Ports and Lighthouses Administration, Alexandria. Insulated cables and terminal joint boxes. (E.S.B. 26390/54. Ten/11411.)* 13th December. Tubular street lighting standards and lanterns. (E.S.B. 26446 54. Ten/11402.)*

5th February. Telegraph and Telephone Administration, Cairo. Radio telephone and telegraph terminal equipment. (E.S.B. 26099/54. Ten/11379.)*

India.—13th December. Government of Andhra Electricity Department, Madras. One 4,000 kVA and one 7,500 kVA transformers. (E.S.B. 26116/54. Ten/11363.)* 20th December. Switchgear and transformers. (E.S.B. 26586/54. Ten/11427.)* 6th January. Instruments for a standards laboratory. (E.S.B. 26575/54. Ten/11428.)*

6th December. Government of Madras Electricity Department. Distribution transformers. (E.S.B. 26657/54. Ten/11438.)* 3rd January. Materials for 110 kV line. (E.S.B. 26115/54. Ten/11366.)* 5th January. Power transformers. (E.S.B. 26574/54. Ten/11425.)*

Jordan.—Nablus Corporation. Diesel generating sets, overhead lines, switchgear and transformers. (See this issue.)

Kuwait.—1st February. Government Electricity Department. Four 10,000 kW gas turbo-alternators, four 10,000 kW steam turbo-alternators and four 125,000 lb/hr steam raising units. (See this issue.)

Madeira.—29th November. Administrative Commission of the Madeira Hydraulic Schemes, Lisbon. Cables for underground and overhead transmission, transformers, switchgear, etc. (E.S.B. 22638/54. Ten/11434.)*

Mozley.—3rd December. Corporation. Street lighting equipment. (See this issue.)

New Zealand.—18th January. Post and Telegraph Department, Wellington. Valves. (E.S.B. 26127/54. Ten/11354.)* Cable and flexible cord. (E.S.B. 26128/54. Ten/11373.)*

3rd December. Electric Power Board, Auckland. Insulated cable. (E.S.B. 26569/54. Ten/11430.)*

28th February. Auckland Transport Board. Thirty-four trolley-buses. (E.S.B. 26396/54. Ten/11415.)*

Saudi Arabia.—20th January. Ministry of Communications, Jedda. Materials for telephone open wire long distance lines and open wire short distance subscribers' lines. (E.S.B. 25903/54. Ten/11319.)*

Sheffield.—7th January. City Architect's Department. Mechanical and electrical installations for the first stage of the Colleges of Technology and Commerce. (See this issue.)

South Africa.—9th December. Union Tender and Supplies Board, Pretoria. Dial mountings and plugs. (E.S.B. 26065/54. Ten/11355.)* Lamps and multiple jacks for telephone switchboards. (E.S.B. 26066/54. Ten/11353.)*

9th December. Tender Board, Johannesburg. Heat treatment plant. (E.S.B. 26484/54. Ten/11408.)* Mercury arc rectifier equipment. (E.S.B. 26460/54. Ten/11409.)*

Stirling.—County Council. Street lighting installation. (See this issue.)

Tiverton.—10th December. R.D.C. Street lighting equipment. (See this issue.)

Twickenham.—8th December. Corporation. Street lighting equipment. (See this issue.)

United States.—30th November. Chicago Procurement Office, Corps of Engineers. Sixty 100 kW generator sets. (E.S.B. 26330/54. Ten/11435.)*

21st December. Corps of Engineers, U.S. Army, Portland, Oregon. 15 kV system electrical equipment for generators and main units, Dallas dam. (E.S.B. 25987/54. Ten/11337.)*

Uruguay.—14th December. Usinas Electricas y los Telefonos del Estado, Montevideo. Outdoor conductors. (E.S.B. 26406/54. Ten/11404.)* 24th December. Insulators for telephone use. (E.S.B. 26439/54. Ten/11394.)* Lampholders and lighting receptacles. (E.S.B. 26408/54. Ten/11396.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

ORDERS PLACED

Birkenhead.—Education Committee. Electric lighting installation at Rock Ferry High School extensions (£1,785).—Cousins, Ltd.

Larne.—Borough Council. Equipment for the town's new street lighting installations (£11,406).—British Thomson-Houston Co.

Stockton-on-Tees.—Corporation. Electrical installations in 66 houses and 42 flats on the Portrack and Newtown housing estates (£2,511).—J. Emmerson.

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors.

Acton.—Factory, Park Royal Road; H. White and Son, Ltd., heating engineers, 133, Regent Street, London, W.1.

Barnsley.—Reconstruction of Gaumont Cinema; Circuits Management Association, Ltd., Albion House, 59, New Oxford Street, London, W.C.1.

Belfast.—New Odeon Cinema at Castle Street corner site; H. W. Weedon & Partners, architects, 45, Calthorpe Road, Birmingham, 15.

Bromley.—Flats (66), Blyth Road; Charles W. Fox, architect, 22, Park Way, Welwyn Garden City.

Burslem.—Works extensions; Acme Marls, Ltd., William Clowes Street.

Canterbury.—Houses (150), Barton estate; New Ideal Homesteads, Ltd., estate developers, South Street, Epsom, Surrey.

Chelmsford.—Extensive buildings for distribution purposes, Widford estate; Unilever, Ltd., Unilever House, Blackfriars, London, E.C.4.

Chislehurst and Sidcup.—Flats (34), Elmstead Lane and Palm Avenue, for U.D.C.; T. W. Fagg, clerk, Council Offices, Sidcup, Kent.

Coalville.—Secondary school; county architect, Leicester.

Consett.—Proposed three-storey premises for Y.M.C.A. (£60,000); S. W. Milburn and Partners, architects, 9, Esplanade, Sunderland.

Croydon.—First stage of extensions to Ashburton Secondary Schools (£65,000); E. Taberner, town clerk.

Glasgow.—Multi-storey flats at Toryglen; Scottish Special Housing Association, Edinburgh.

Hereford.—First stage of scheme for college of further education, Broadlands (£116,000); county architect, Bath Street, Hereford.

Hinckley (Leics).—Twenty-seven blocks containing 108 flats, Sketchley Hill estate; U.D.C. surveyor.

Holbeach.—First instalment of £160,000 secondary modern school; county architect, Boston, Lincs.

Leyland.—R.C. school at Fox Lane; Weightman & Bullen, architects, 76, Rodney Street, Liverpool.

Llandudno.—R.C. school, Rhuddlan Avenue; Patrick & M. White, architects, 40, Granville House, Arundel Street, London, W.C.2.

London.—Offices, Fulwood Place, Bloomsbury; R. Seifert, architect, 28, Great Ormond Street, W.C.1.

Newcastle-on-Tyne.—First stage of new Town Hall (£643,000); city architect.

Norwich.—Public abattoir at Harford (£114,000); city engineer, City Hall.

Poole.—Factory, Fleets Bridge; G. & F. Maidment (Poole), Ltd., Cranbrook Road, Parkstone.

Reading.—Office block, Friar Street; Prudential Assurance Co., Ltd., Holborn Bars, London, E.C.1.

Rugeley.—Factory at Brereton; Edward Pinchess & Co., Ltd., Mill Lane, Rugeley, Staffs.

St. Helens.—Extensions to factory for Beechams (Northern), Ltd.; Quiggen & Gee, architects, 11, Old Hall Street, Liverpool.

Southampton.—Retail premises at 164-168, Portswood Road; F. W. Woolworth & Co., Ltd., 1, New Bond Street, London, W.1.

South Shields.—Public buildings including clinic, library, offices and community hall, Boldon Lane; borough engineer.

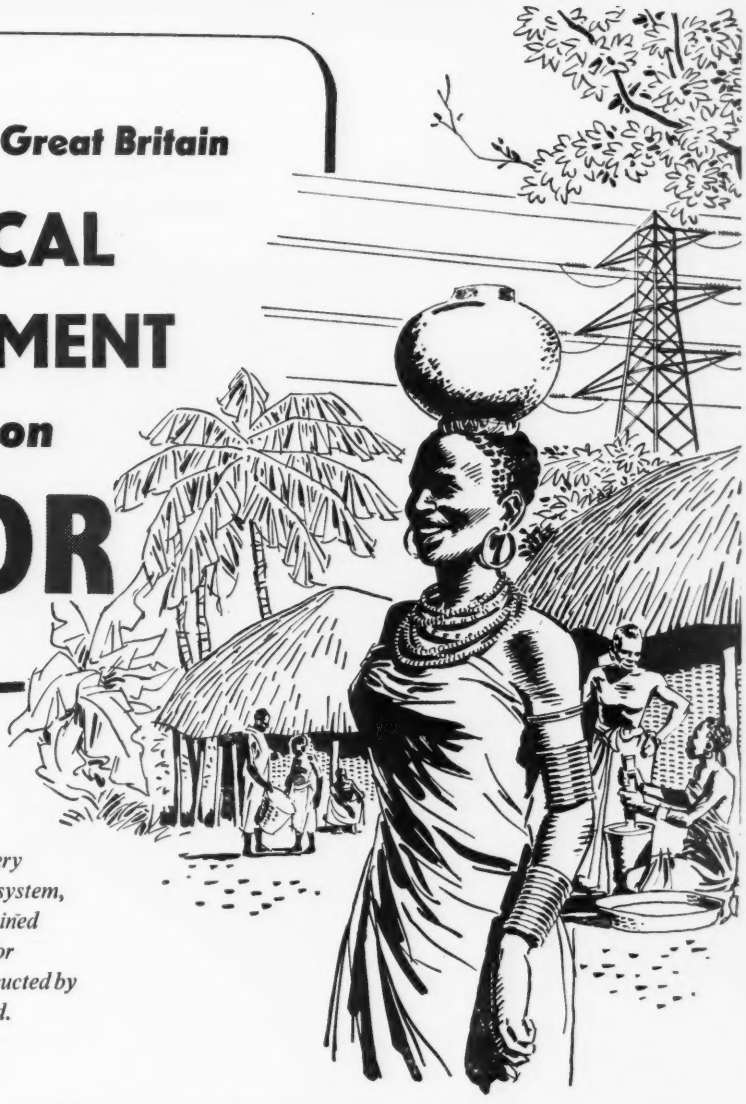
Stockton-on-Tees.—Central laundry, Portrack Hospital (£15,000); Newcastle Hospital Board, Dunira, Osborne Road, Newcastle-on-Tyne.

Stretford.—C. of E. church, Barton Road; Leach, Rhodes & Walker, architects, 90, Deansgate, Manchester.

Wednesbury.—Extensions to factory and office block, Friar Park Road, for Smith & Davis, Ltd., brassfounders; Alan Snow, architect, 146, Corporation Street, Birmingham.

In East Africa as in Great Britain

ELECTRICAL DEVELOPMENT *depends on* TUDOR



The East African Power and Lighting Company Limited have incorporated a number of Tudor Battery equipments in their electricity supply system, including a 110-volt battery and combined charging rectifier/D.C. switchboard for Wanjii Power Station, recently constructed by Balfour, Beatty and Company Limited.

FOR OVER FIFTY YEARS The Tudor Accumulator Company has specialised in the design and manufacture of batteries for switchgear operation, indication and emergency duties in power stations and substations; and Tudor Batteries have played a large part in the recent expansion of electricity supply in Britain. Wherever they are in service, Tudor Batteries are noted for their outstanding reliability and low maintenance cost under all conditions.

Tudor engineers will be pleased to prepare a specification of the most economical battery scheme to meet your requirements. There are Tudor agents in most parts of the world.

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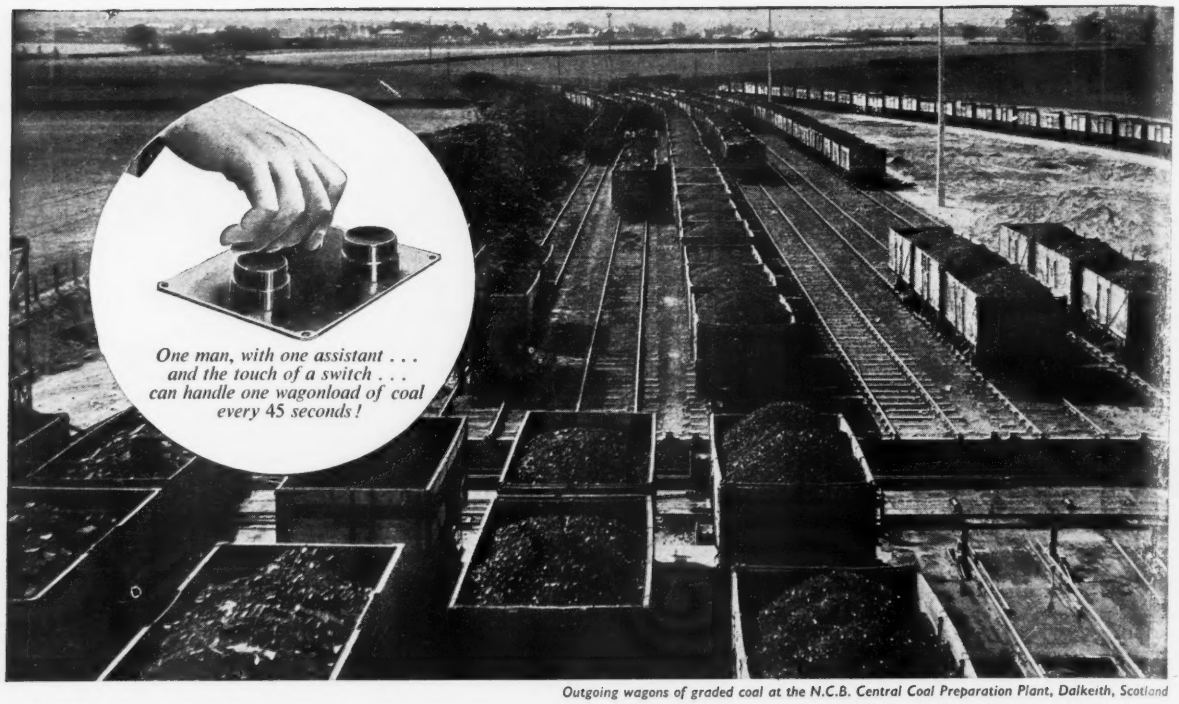


Outgoing wagons of graded coal at the N.C.B. Central Coal Preparation Plant, Dalkeith, Scotland

NEW APPROACH TO WAGON HANDLING

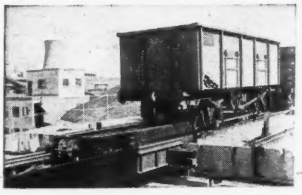
. . . Mitchell system means smaller sidings, quicker turnround, less gear, greater safety

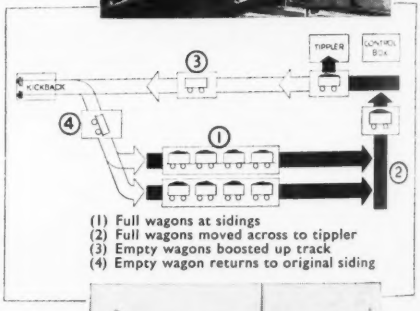
How many men work on your coal sidings? How many locomotives or capstans? What space is wasted by sprawling tracks? How much tonnage can you handle per hour?

The generally unsatisfactory answers given to such questions as these inspired the design of the Mitchell system of wagon handling—a mechanical, electrically-controlled system that offers remarkable scope for increased efficiency at power stations, collieries, coal preparation plants, steelworks, etc., and other centres of industry possessing marshalling yards.

The Mitchell system can be operated by two men. It takes wagons from the arrival sidings, loads or unloads them, weighs them and remarshals ready for departure. Wagons can be emptied and returned to the same siding they arrived at "full" so that one track is used for full and empty wagons. No internal shunting, no additional motive units, no man-handling other than initial uncoupling and final recoupling, are required. The system has no limit to size or capacity and can easily handle the 1000 tons or more of coal per hour which is now being called for. And it does it with the highest degree of safety, in all weathers, round the clock if needs be.

By demanding no more than half the space occupied by traditional balloon sidings, the Mitchell system makes possible the erection of new plant on sites hitherto unsuitable, with very large savings in initial and later costs. Its flexibility makes it adaptable to any individual handling problem. Installations are already at work for the National Coal Board and the British Electricity Authority. The thoroughgoing efficiency and economy of the Mitchell system puts it far in advance of any traditional method and establishes it as the system of the future.





(1) Full wagons at sidings
(2) Full wagons moved across to tippler
(3) Empty wagons boosted up track
(4) Empty wagon returns to original siding

An installation at the British Electricity Authority, Freemens Meadows, Leicester, handling 800 tons of coal an hour. The site is limited in area and normal methods of working with balloon sidings would be impractical. The pictures show the traverser pulling an incoming truck on to the transfer rail and an emptied wagon being returned to the siding by the 'kickback'.

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- PERMANENT
- PILFER PROOF
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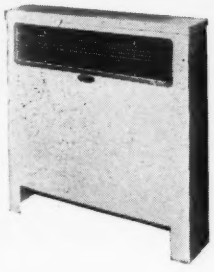

Robust Construction

Accessible for service

Easy to instal

Economical

1 kW Convector £6.10.0 list plus purchase tax.

1½kW & 2kW Convector £7.0.0 list plus purchase tax.

3 kW Convector £9.0.0 list plus purchase tax

Specification—

Case: Heavy Gauge Sheet Steel.
Elements: High-grade Nickel Chrome. Black Heat, easily replaceable.
Finish: Polychromatic Bronze. Special colours charged extra.

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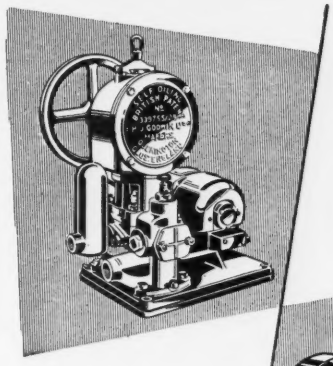
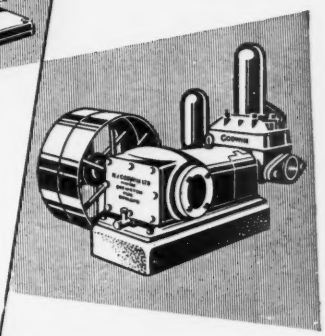


TYPE "AIE"

Patent Electric Domestic Pump for Suction Lifts up to 25 ft. 250/300 Imp. GPH to a total head of 80/120 ft. ALLOY PUMP BODY and many other exclusive features.



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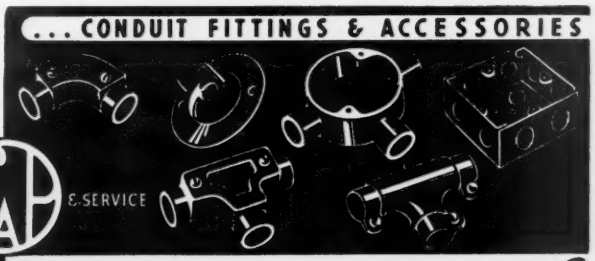

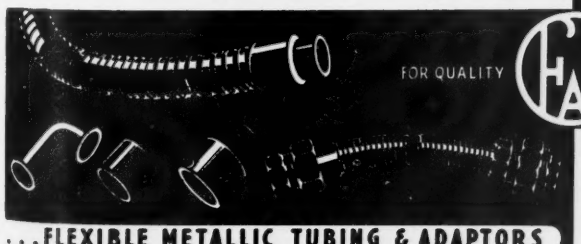

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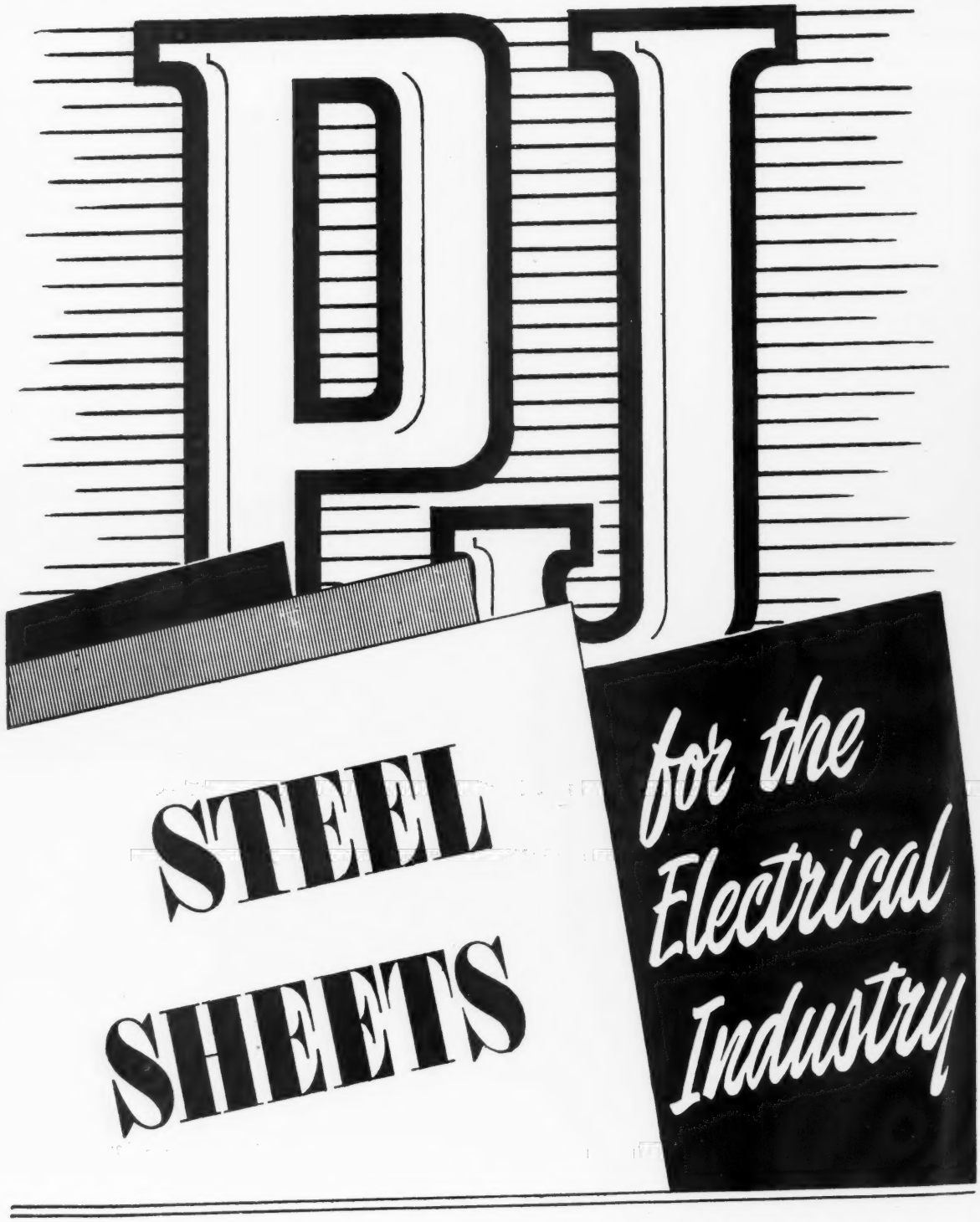

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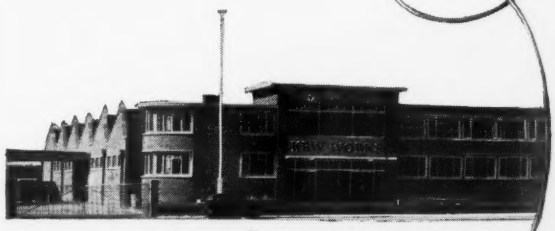

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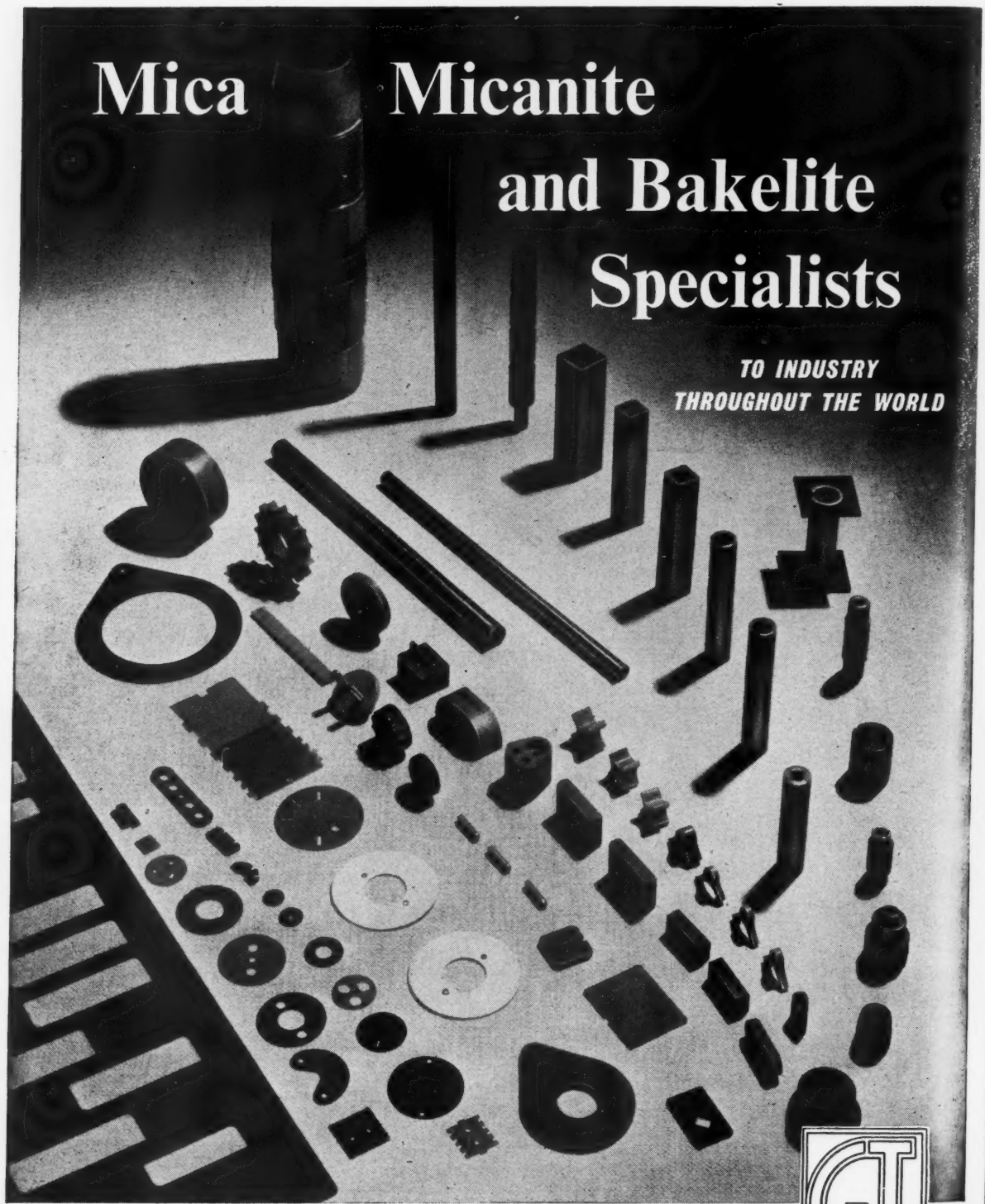

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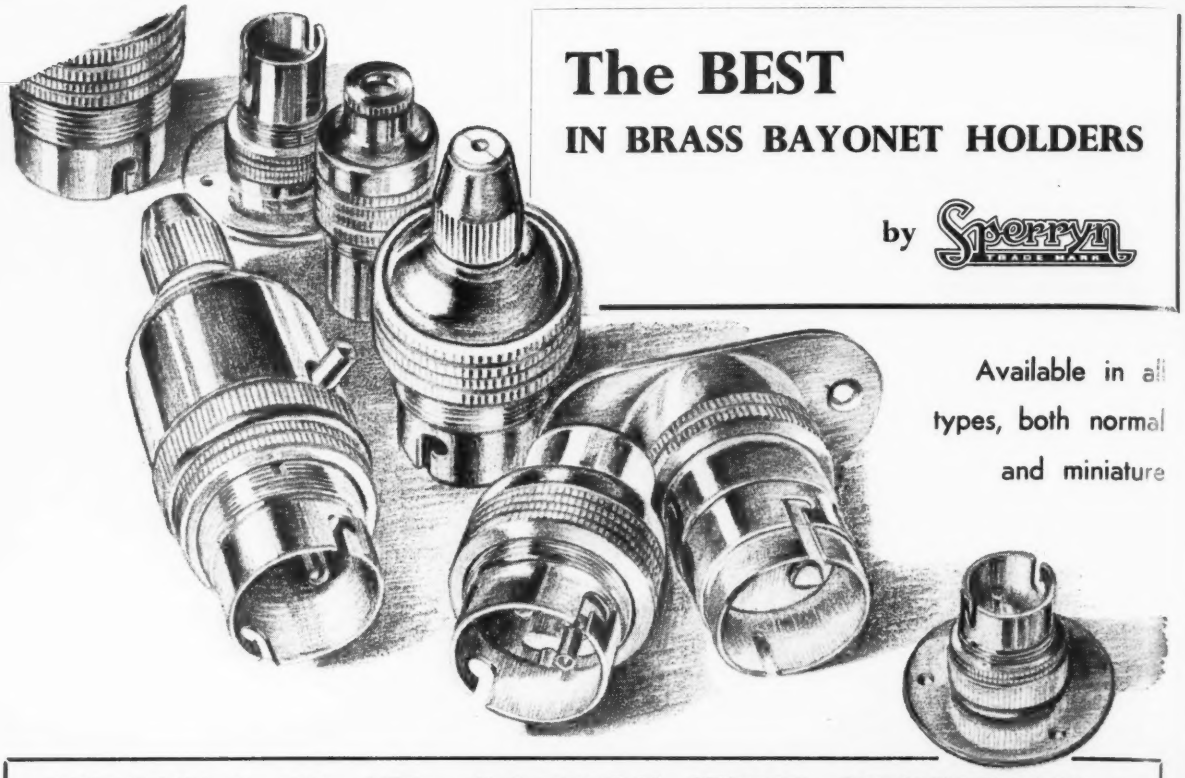

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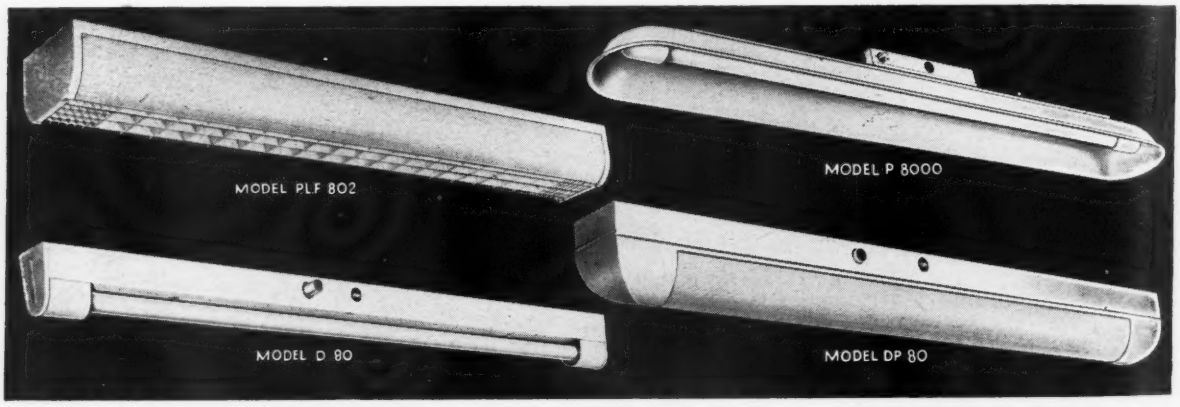

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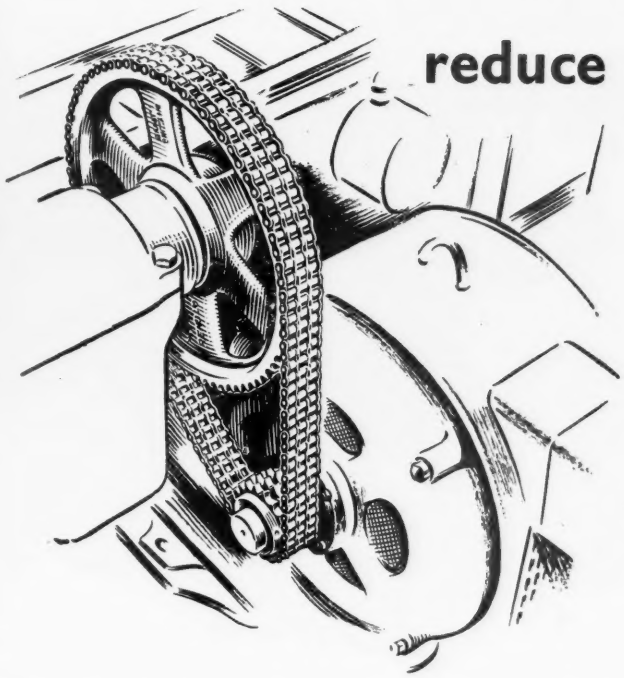

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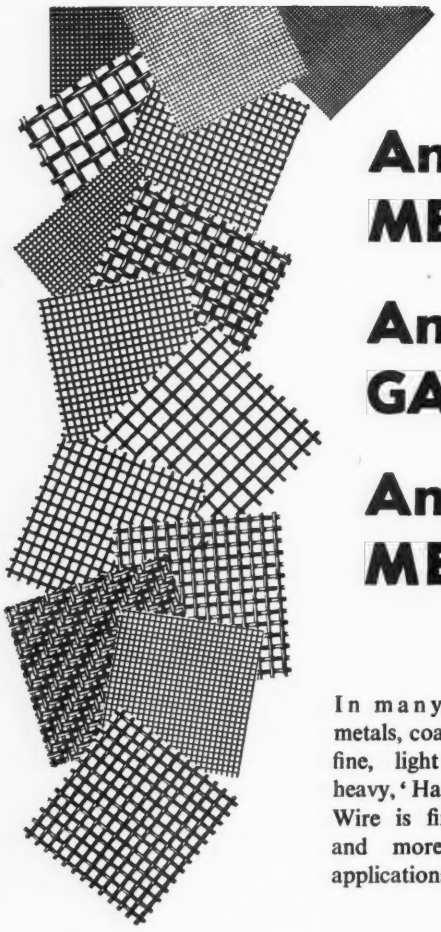

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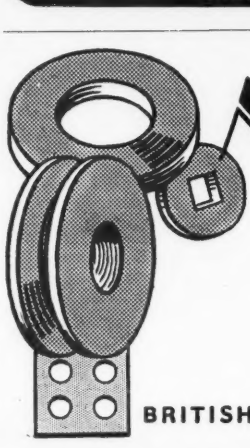

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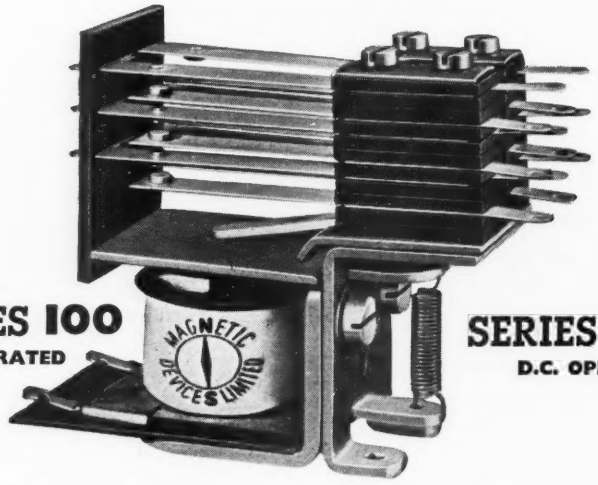

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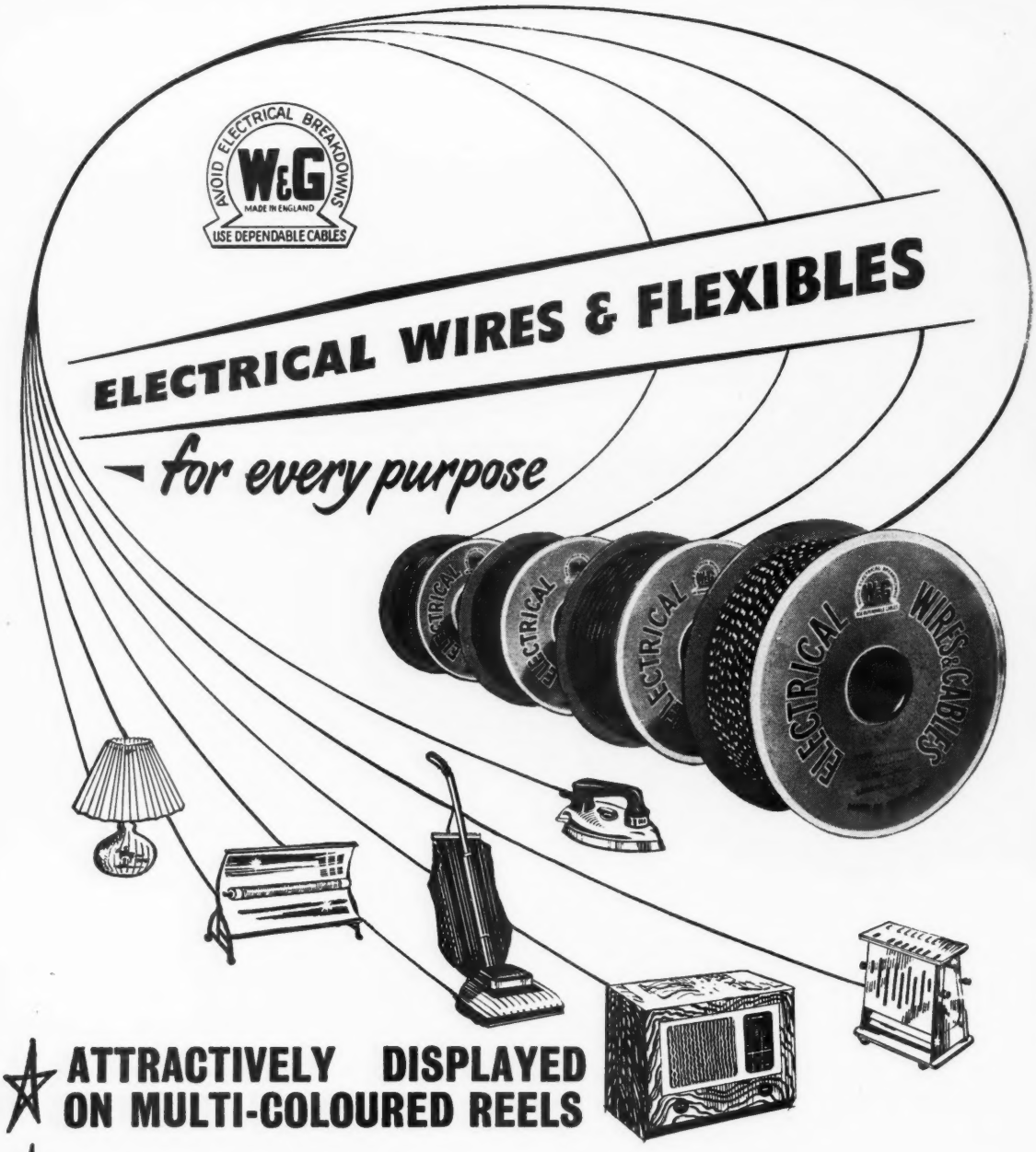

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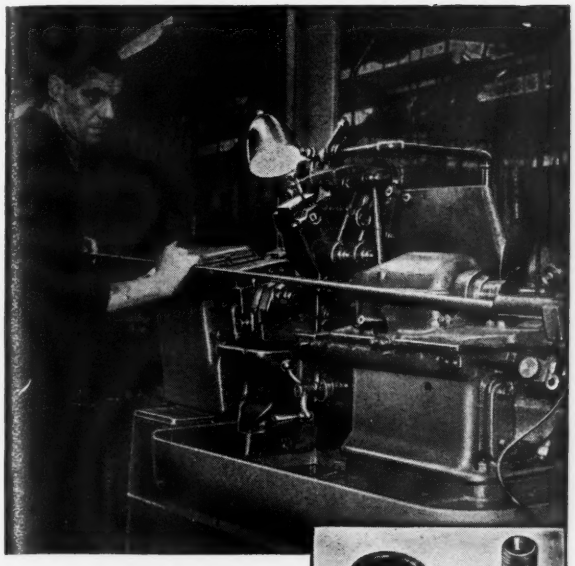

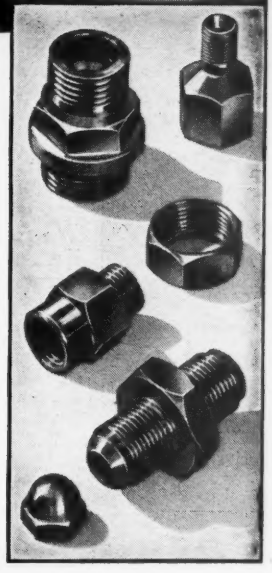

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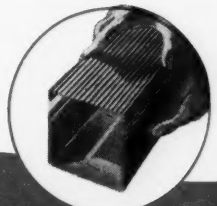

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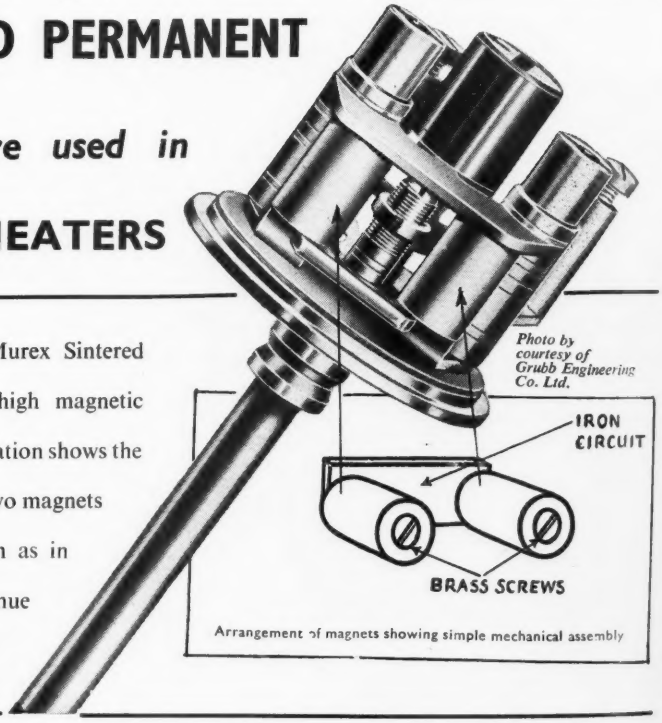
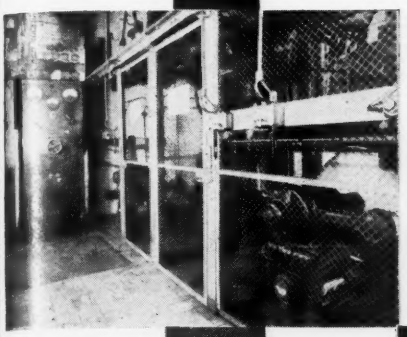


Photo by courtesy of Grubb Engineering Co. Ltd.

Arrangement of magnets showing simple mechanical assembly

MUREX LIMITED (*Powder Metallurgy Division*), RAINHAM, ESSEX. *Rainham, Essex 3322*

London Office : CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.1. *EUSton 8265*



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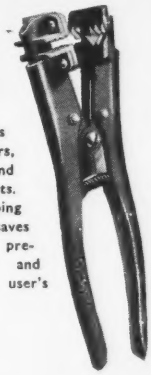
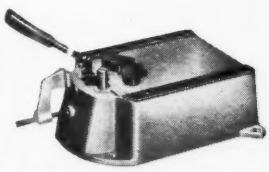


HYDE E-Z WIRE STRIPPER

Used by hundreds of manufacturers, contractors and service agents. Precision stripping with the E-Z saves wasting wire, prevents nicking and protects the user's fingers.

Stripping without teasing



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Strips insulation from cables up to ⅜" outside diameter, no splaying, no nicking; and one single movement does the whole job quickly and cleanly.

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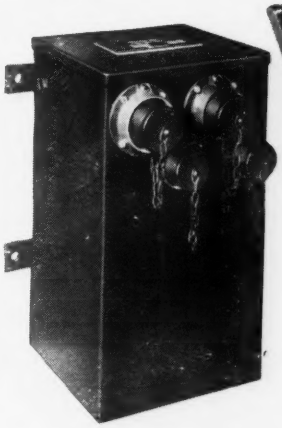

★ *Left:* Type 2361/5 (1000VA.) Two 5 amp. and two 15 amp. outlet sockets.

Above: Interior view of Portable Unit Type P2361/1 showing carrying handle and fuses.

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★ ILLUS.: TYPE 335W30 GEARED MOTOR, WITH AC/DC INTERCHANGEABLE FRAMES. 56-300 R.P.M. TORQUE 3-1 LBS. INS.

The design and manufacture of the best and most reliable small electrical motors is our one and only job. Because of this specialisation, our customers can put their utmost confidence in FRACMO motors. We have all the resources and the knowledge to help with the most efficient solution to any 'fractional' application ... we can save money for you ... we can supply the best small motor for any purpose. Need we say any more ?

The very wide range of "FRACMO" Motors includes:

UNIVERSAL 1/250 to ¼ h.p.
SINGLE, SPLIT PHASE 1/100 to ¼ h.p. and
CAPACITOR 1/80 to 1/6 h.p.
3-PHASE 1/20 to 1/3 h.p.
SYNCHRONOUS 1/100 to 1/15 h.p.
SHADED POLE 1/160 h.p. at 1300 r.p.m.
GEARED UNITS 0.25 to 600 r.p.m. Torque up to 800 lbs. ins.

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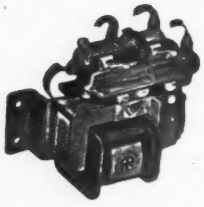
Rookery Way, Hendon, N.W.9. Telephone: Colindale 8022/3/4

Our Birmingham address is: 6 Lansdowne Road, Erdington, Birmingham 24. Telephone: Erdington 0460

A.C.–D.C. RELAYS

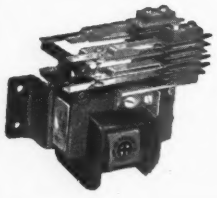


AS COMPONENT PARTS OR COMPOSITE EQUIPMENT

•

LAMINATED MAGNETIC RELAYS

•



TYPE AR/C SILVER CONTACTS

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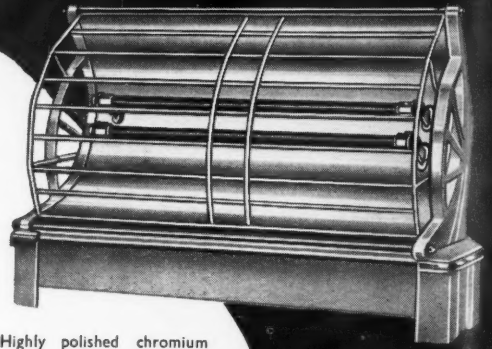
APPLIED RADIATION LTD.

Apperley Bridge, Bradford

Telephone: IDLE 686

THE *Crossland* RAYDANT ELECTRIC FIRE



Highly polished chromium plated reflector and approved guard. Robust construction. Generous dimensions 17" wide, 11½" high, 6" deep. Excellent finish stoved cream enamel. Approved by Electricity Boards.

LIST PRICES

Model No. 800/1 One kW Fire
£2.7.6 P.T. 17/2

Model No. 800/2 Two kW Fire
£3.4.2 P.T. £1.3.2

Range 200/220v 230/250v

THE FIRE THAT ALWAYS SELLS.

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55 Ebury Street, London, SW1
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The ARISTOCRAT of CABLES

You can be sure of complete satisfaction from Rists T.R.S. and V.I.R. house wiring cables.

Manufacturers of Cables for internal maintenance wiring, electric fans, soldering irons, welding and trailing purposes, switchboard panel wiring, stove wiring and generally for all industrial uses.

RISTS

"WELL RUN ME INTO BOW STREET," SAYS P.V.C. 99, "IF THESE DON'T 'BEAT' THE LOT."

BRITAIN'S LARGEST MAKERS OF THERMOPLASTIC CABLES

Please write for further details to Electrical Division.

RISTS WIRES & CABLES LTD.

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Telegrams: "Rist's, Newcastle, Staffs"
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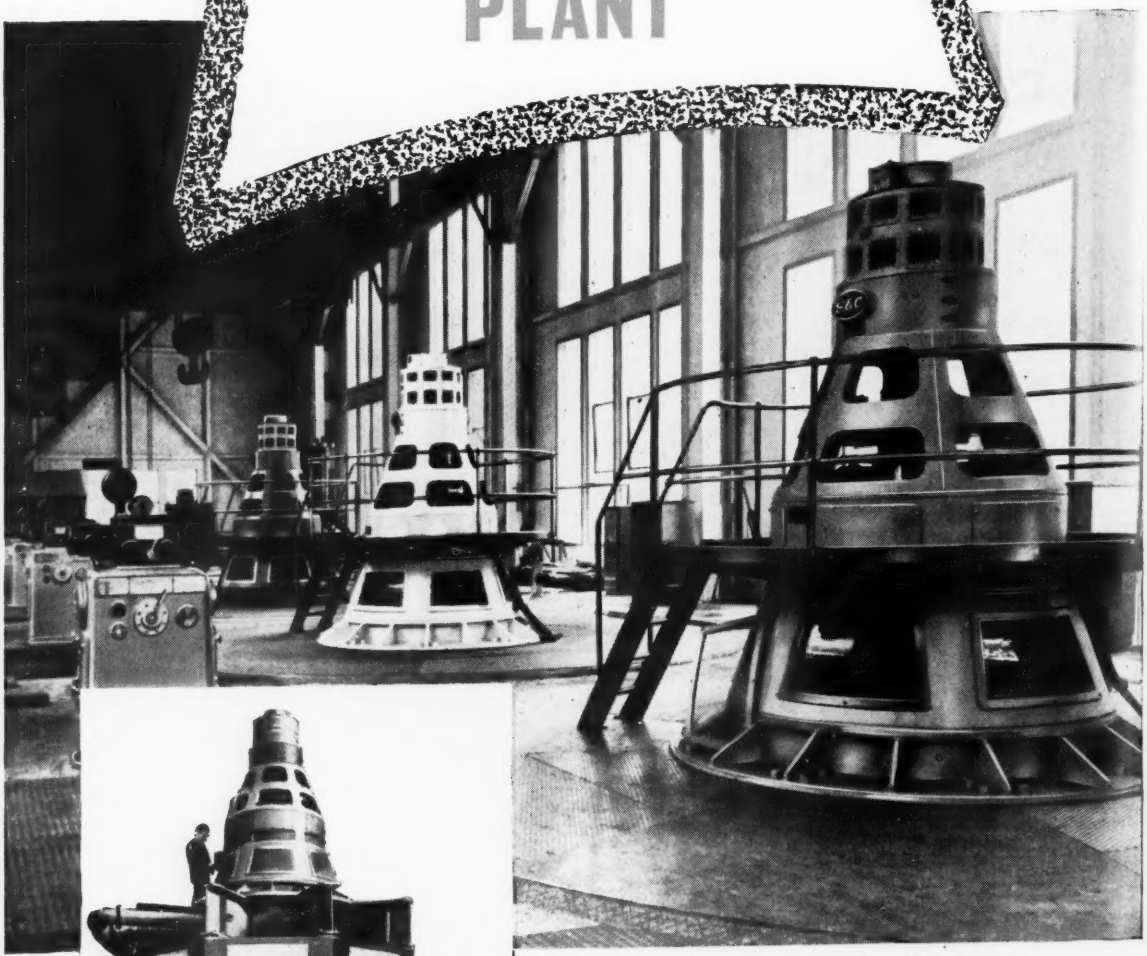
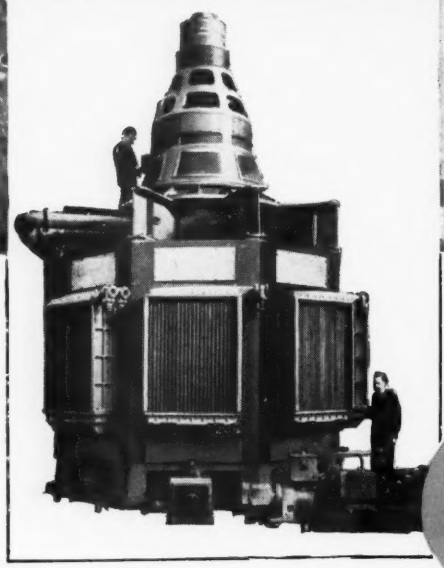
HYDRO-ELECTRIC PLANT



Three of five 25 MW, 11 kV., 600 r.p.m. sets in the Tungatinah Power Station, Tasmania.



One of the above alternators erected for test.

G.E.C.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

The connection is obvious

H. C. ELECTROLYTIC COPPER WIRE, BARS AND STRIP

By Spencer Wire

THE SPENCER WIRE CO. LTD., THORNES WIRE MILLS, WAKEFIELD, YORKS.

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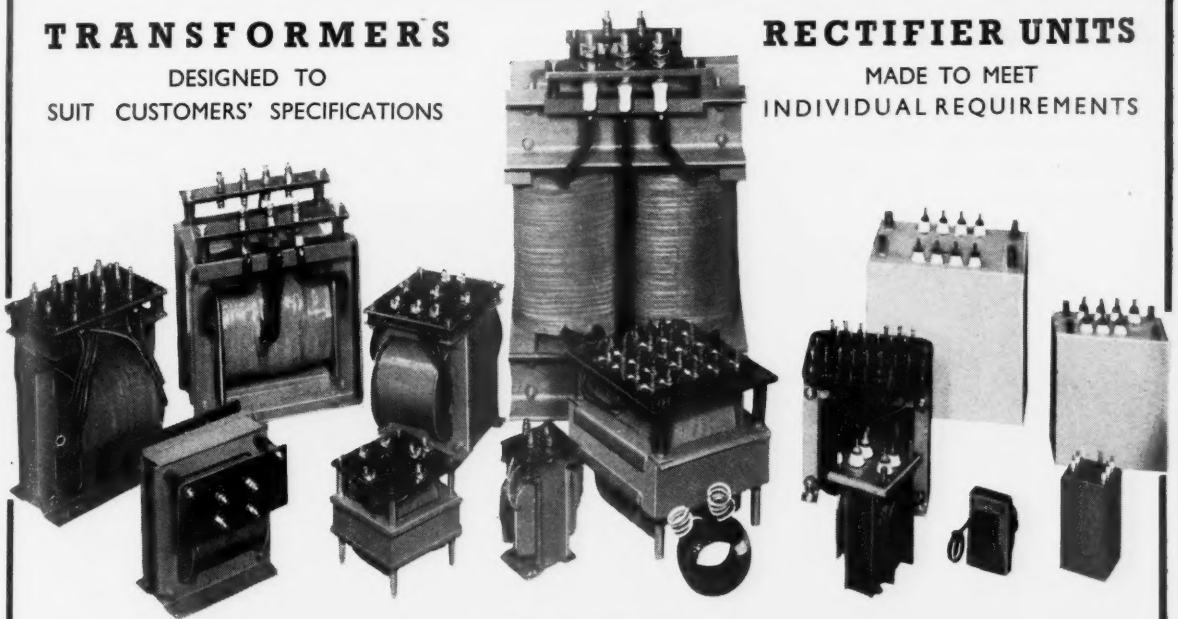
DESIGNED TO SUIT CUSTOMERS' SPECIFICATIONS

RECTIFIER UNITS

MADE TO MEET INDIVIDUAL REQUIREMENTS



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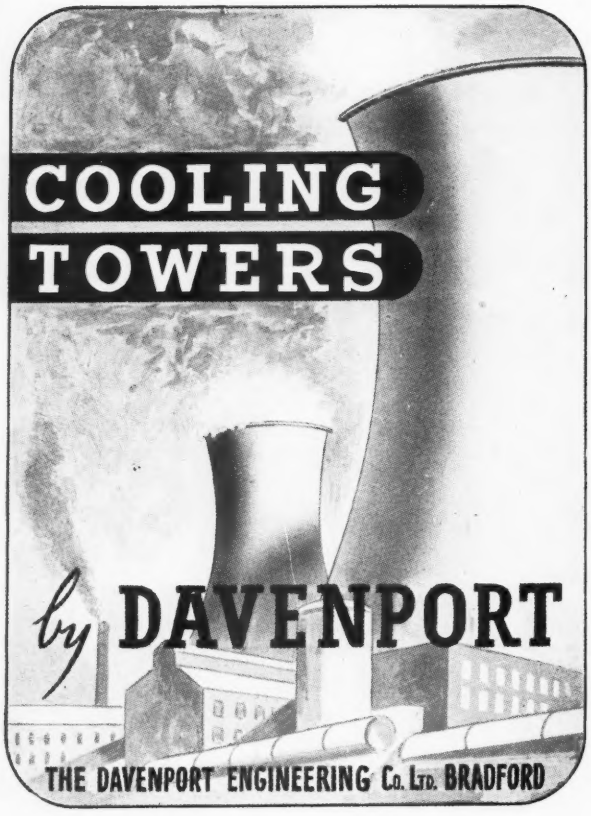
AUSTIN WALTERS & SON LTD. AYRES ROAD, OLD TRAFFORD MANCHESTER, 16. PHONE TRAFFORD PARK 1827 (2 Lines)



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PLASTICS FOR INDUSTRY?
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have the experience AND the equipment
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One of the group of companies associated with the Southern Areas Electric Corporation Limited

if it's valves...

the right answer to the problem is most likely to be found in our extensive range of manual, power-operated, and self-acting types, available in standard and special versions for the vast majority of power plant and industrial applications. For a quick survey of the principal lines, write for List E. 214.

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A3 ndh 3815

"Wrigley" Regd.

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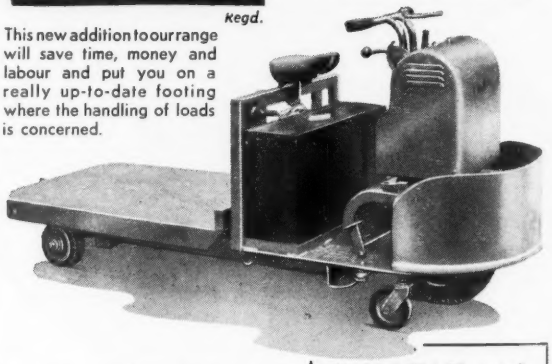
GET PRODUCTION MOVING!

This new addition to our range will save time, money and labour and put you on a really up-to-date footing where the handling of loads is concerned.



WRIGLEY products include 1 & 3 h.p. PETROL TRUCKS, TUGS, TIPPERS, DUMPERS, FORK LIFTS, also HEAVY INDUSTRIAL TRAILERS.

★ FULL DETAILS on request.

Model E. 534 (illustrated) ELECTRIC BATTERY OPERATED STILLAGE TRUCK. Driver control. Steel platform 4' x 2' 6". Load capacity 15/20 cwts. Smooth running, easily manoeuvrable and extremely economical to run and maintain.

WESSEX INDUSTRIES (Poole) LTD
WEST STREET POOLE DORSET
Tel.: POOLE 900

Measurement

single disc polyphase meter

1. In its neat bakelite insulated case the most compact meter on the market.

2. Half the size and weight of three disc type.

3. High torque weight ratio.

4. Negligible interaction.

5. Torque balance and all other adjustments readily accessible.

6. Anisotropic brake magnets giving maximum stability.

7. Outsize performance that makes it just right for your requirements.

Measurement Ltd

ELECTRICITY METERS

Tameside Works, Dobcross, Nr. Oldham. Tel. No. Delph 291.

HYDRAULICS DIVISION

119 Union Street, Oldham.
Tel. No. MAln (Oldham) 6432/3/4.

Terminal House, Grosvenor Gardens, London, S.W.1. Tel. No. SLOane 0111.

Export enquiries to Parkinson & Cowan Group Exports Ltd., Terminal House, Grosvenor Gardens, London, S.W.1. Tel. No. SLOane 0111.

Not much to grouse about...

NOW WE'RE GETTING TRU-WEL TUBES

True enough! You never have to complain about a Tru-Wel E.R.W. tube. Manipulated components marry up to the assembly as snugly as you please; and as for straight lengths —well, did *you* ever know a Tru-Wel tube that wasn't true?

But there's more to it than that. Strength, lightness, concentricity, composition—the things that really matter with tubes—are uniform for every batch of Tru-Wel. If one tube fits, they all fit. If one does the job, they all do it.

Tru-Wel Electrically Resistance Welded Steel Tubes
Supplied in straight lengths from ½" o/d to 4⅞" o/d in gauges 22 to 6, or manipulated to your special requirements. Also available in a range of standard sections.

Tru-Wel Stainless Steel Tubes
In straight lengths from ½" o/d to 2" o d in gauges 20 to 12 or manipulated to measure, are made from most Austenitic Nickel Chrome Steels, and some Ferritic Nickel-free steels.

tested... tried... trusted

TRU-WEL
Electric Resistance Welded
STEEL TUBES

TUBE PRODUCTS LIMITED, OLDBURY, BIRMINGHAM

A TI COMPANY

MINIATURES are in vogue

Miniaturist painters, or limners as they were known, flourished in the first Elizabethan age, when it was fashionable for royalty and nobility to bedeck themselves with these costly ornaments. Nicholas Hillyarde, a Devonian, probably the greatest English miniaturist, was appointed as limner to Elizabeth I, and was confirmed in the appointment by James I. In his well-known treatise Hillyarde says of his equally accomplished pupil, Isaac Oliver, "His drawings were finished to a mighty degree of perfection." With due modesty may we say that this is the link with Hoffmann Miniature Ball Bearings. The rolling elements are tiny steel balls, perfect mirrored spheres and these revolve between perfectly finished tracks. They are suitable for all small movements where smooth sensitive operation is of paramount importance. All engaged in the design of electronic and other instruments should acquaint themselves fully with their uses and you are invited to ask for our leaflet LT 13 which describes the range we are at present making.

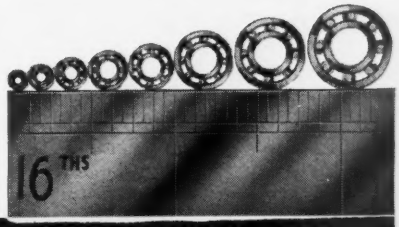
HOFFMANN

precision

MINIATURE BALL BEARINGS

ENGINEERS are going in for them

Ask for a copy of our leaflet LT 13



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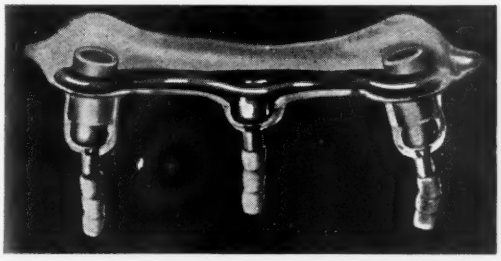
BEST YOU CAN BUY IN BRITAIN



is what we aim for in the production of

I.A.C.

MERCURY SWITCHES

and prompt deliveries from the widest range of types and sizes.

I.A.C. LTD. Dept. E/R., 10 CHASE ROAD LONDON, N.W.10

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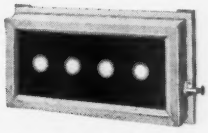
ELECTRICAL PRODUCTS

UNDERDOME TYPE BELLS FOR AMBULANCE, FACTORY And FIRE TENDER USE



MECHANICAL REPLACEMENT INDICATORS, SURFACE OR FLUSH MOUNTING

MERCURY TUBE RELAYS

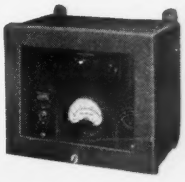
Other Products include

Ironclad Bells

Luminous Indicators

Transformers

Wall Sockets & Plugs



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TRADE MARK

JULIUS SAX & CO. LTD.

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Telephone EALING 6034-5

MINI-SWITCHES
WITH THE ACCENT ON MINI
An entirely new range of small snap-action switches in various forms suitable for many purposes. Catalogues, giving complete details, available on request.
CRAIG & DERRICOTT LTD.
ROYAL WORKS, SUTTON COLDFIELD
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Explains costing techniques to the engineer in the shop

Now Ready

Cost Accounting and the Engineer

By Kenneth B. Mitchell, A.C.W.A., Aff.I.W.M. This new book sets out to explain cost accounting and how it operates to the engineer on the shop floor. The approach is simple and direct, the reader being shown in a practical manner how modern cost accounting influences every department. Special attention is given to problems of budgeting and budgetary control.

CONTENTS

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$8\frac{3}{4}'' \times 5\frac{1}{2}''$ 126 *pp. Illustrated.* **10s. 6d. net.** *By post* 10s. 9d.

Published for "Machine Shop Magazine"

From booksellers or direct from :—

Iliffe & Sons Limited, Dorset House, Stamford St., London, S.E.1

MICA

Processed for all uses
COMMUTATOR SEGMENTS
HEATING ELEMENTS
SWITCHGEAR, ETC.

VARNISHED COTTON
INSULATING SLEEVING
In various colours — Deliveries from stock

Special Organization for prompt deliveries

L. VANDERVELDE LTD. Gnome Works, Stansted Essex. Phone: Stansted 3261

TRANSFORMERS of all types up to 25 kVA for Single or Three Phase operation, Phase Conversion, etc.

INDUCTA

COILS for Contactors, E.M. Brakes, Air Valves, etc. and COIL WINDINGS, for all purposes.

MAINS, Output, and Special Purpose Transformers for Radio Equipment, Chokes, etc.

SOLENOIDS for A.C. and D.C. Operation. A.I.D. APPROVED.

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INDUCTA WORKS
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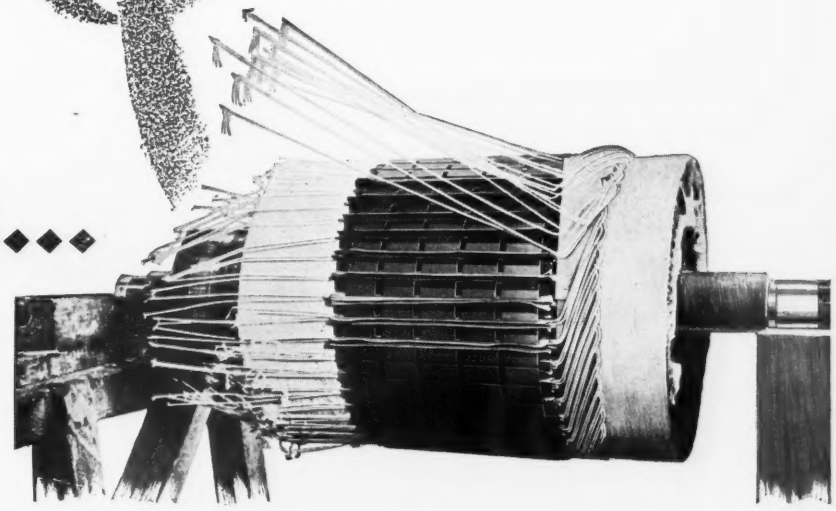
REWINDING...

& REPAIRS...



The extensive winding and repair departments cater for all types of electrical plant and machines up to about 2,000 horse-power and transformers of ratings up to 500 Kva. Long experience and modern production methods ensure a reliable and outstanding service.

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BOLEYN CASTLE, GREEN STREET, UPTON PARK, LONDON, E.13 Tel: GRA 4003 (4 lines)

Cold going to work

Warm premises when they arrive

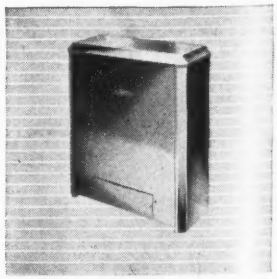
Warm all through the day

The Nightstor Heater is a most economical way of heating offices, school-rooms, workrooms and most commercial buildings. It stores heat at night, when cheaper electricity is available. A Nightstor installation is entirely automatic. It provides comfortable working temperatures throughout the day.
The Nightstor Heater is available in three sizes. Write for descriptive leaflet H02482.

Nightstor *heater a* **G.E.C.** *product*

stores heat at night

for use next day



THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE KINGSWAY LONDON WC2

CLASSIFIED ADVERTISEMENTS

ADVERTISEMENTS are accepted up to **First Post on Monday** of the week of issue, and should be addressed to Classified Advertisement Department, Dorset House, Stamford Street, London, S.E.1.

CLASSIFIED advertisements are PREPAID at 3/- per line (approx. 6 words) per insertion. Where an advertisement includes a Box Number this counts as two words and carries an additional charge of 1/-.

DISPLAYED:—£2 per inch, per insertion. Cheques and Postal Orders should be crossed and made payable to ELECTRICAL REVIEW PUBLICATIONS LTD.

SITUATIONS WANTED:—Three insertions under this heading can be obtained for the price of two if ordered and prepaid with the first insertion.

REPLIES to Box Numbers should be addressed to the Box Number in the advertisement, c/o ELECTRICAL REVIEW, Dorset House, Stamford Street, London, S.E.1, but if not to be delivered to any particular firm or individual they should be accompanied by instructions to this effect, addressed to the Manager of the ELECTRICAL REVIEW. Replies in such cases cannot be returned. The name of an advertiser using a Box Number will not be disclosed.

Original testimonials should not be sent with applications for employment

OFFICIAL NOTICES, TENDERS, ETC.

BIRMINGHAM TAME & REA DISTRICT DRAINAGE BOARD

Sludge Digestion Plant at Minworth Works

Electrical Equipment

TENDERS are invited:—

(a) For the supply and delivery only of one or more of the following items:—

No. E.10—H.V. Switchgear.
No. E.11—500-kVA Transformer.
No. E.12—M.V. Fuseswitchboard.
No. E.13—Motor Control Gear.
No. E.18—1,000-kVA Transformer.

(b) For the supply, delivery, installation and cabling of:—

No. E.17—M.V. Switchgear at Humus Tank Substation.

The successful tenderers will be the subject of nominated sub-contracts with the Board's main contractor.

Sub-contract documents may be obtained from the Engineer to the Board, Rookery Park, Erdington, Birmingham, 24, on payment of £1 1s. deposit on each item. Deposits will be returned on receipt of a bona fide tender not subsequently withdrawn, or on notification of inability to tender and return of tendering document received not later than three days prior to the closing date.

Tenders in the envelopes provided must be delivered to the undersigned not later than noon on Monday, 13th December, 1954.

The Board is not bound to approve for nomination the lowest or any other tender.

ARTHUR J. WRIGHT,
Clerk to the Board.

Clerk's Office,
115-117, Colmore Row,
Birmingham, 3.
12th November, 1954. 6152

BOROUGH OF COLCHESTER

Street Lighting: London Road & Roundabout Trunk Road A.12

Group "A" Sodium Discharge Lighting

TENDERS are invited for the supply and delivery of 28 Concrete Street Lighting Columns and Brackets, Lanterns and Auxiliary Equipment.

Tenders, in sealed envelopes marked "Trunk Road A.12 Lighting," to be returned to the Borough Engineer not later than Monday, 29th November.

Copy of Specification can be obtained on application to—

J. S. ORCHARD, A.M.I.C.E.,
Borough Engineer.

1, West Stockwell Street,
Colchester. 6156

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Moriston Project: Medium Voltage Switchgear and Ancillary Equipment for Cluanie Dam Compensation and Loyne Tunnel Water Generating Stations

TENDERS are invited for the provision of the above-mentioned switchgear and equipment. Copies of the tender document may be obtained on application with cheque for two guineas (returnable) to the Engineers, Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16, Rothesay Terrace,
Edinburgh, 3. 6155

CITY OF SHEFFIELD

To Engineering Contractors (Heating and Electrical)

Colleges of Technology and Commerce, Pond Street, Sheffield 1

SEPARATE tenders are invited for carrying out:—

(a) MECHANICAL INSTALLATIONS
(b) ELECTRICAL INSTALLATIONS

for the First Stage of the above Colleges. The building comprises an eight-storey block and three single-storey blocks. Only contractors experienced in carrying out large contracts should apply as both services are of a highly specialised and complex nature.

Conditions of contract may be seen and specifications and drawings obtained from the undersigned on deposit of £10, which will be refunded on receipt of a bona fide tender.

Cheques to be payable to "The Sheffield Corporation."

Tenders to be on the official form enclosed and securely sealed in the endorsed envelope supplied, which must not bear any mark indicating the sender, and delivered to the Town Clerk, Town Hall, Sheffield, 1, not later than 7th January, 1955.

The Corporation do not bind themselves to accept the lowest or any tender.

J. L. WOMERSLEY,
A.R.I.B.A., A.M.T.P.I.,
City Architect.

City Architect's Dept.,
Town Hall, Sheffield, 1.
8th November, 1954. 6083

BOROUGH OF TWICKENHAM

Street Lighting Improvement, Hampton Area, Stage 2

TENDERS are invited for the supply and erection of approx. 350 New Cast Iron or Concrete Class B Columns, together with the supply and installation of approx. 875 Class B Lanterns (T.F. lamps) mounted on these and on existing C.I. columns.

Plans may be seen and conditions of contract, specification and bills of quantities obtained upon application to the Borough Engineer, Municipal Offices, Twickenham, and the payment of a deposit of £2, which will be returned on receipt of a bona fide tender not subsequently withdrawn.

Tenders must be delivered to the undersigned in the envelope provided not later than 10 a.m. on Wednesday, 8th December, 1954.

The Council do not bind themselves to accept the lowest or any tender.

W. H. JONES,
Town Clerk.

Municipal Offices,
Twickenham. 6079

BOROUGH OF WREXHAM

Electrical Installation to 272 Houses at Various Sites Within the Borough

TENDERS are invited for the Electrical Installation of the above houses now in course of erection or about to be commenced.

Application for the specification and form of tender should be made to the Borough Engineer and Surveyor, 31, Chester Street, Wrexham, where copies of the plans may also be inspected. The application should be accompanied by a deposit of £2 2s. which will be refunded on receipt of a bona fide tender.

Tenders, sealed in the envelope provided, are to be delivered to the undersigned not later than 12 noon, Monday, 22nd November, 1954.

PHILIP J. WALTERS,
Town Clerk.

Guildhall,
Wrexham.
3rd November, 1954. 6028

MUNICIPAL CORPORATION OF NABLUS

TENDERS are invited for supply, delivery and erection of plant and equipment for Nablus in the Hashemite Kingdom of Jordan.

Any or all of the following specifications can be obtained on application to Kennedy & Donkin, Alliance House, 12, Caxton Street, London, S.W.1, on payment of three pounds (sterling) (non-returnable) for each specification:—

Specification NJ.1: Two 150-kW and two 300-kW Diesel Generator Sets.
Specification NJ.2: 4 miles (6½ kilometres) of 6,600-volt and 16 miles (26 kilometres) of 415-volt Overhead Pole Line Distribution.
Specification NJ.3: 6,600-volt and 415-volt Switchgear.
Specification NJ.4: Six 6,600/433-volt Indoor Distribution Transformers.

Tenders are to be prepared in duplicate. The original is to be posted to the Mayor of Nablus, and the copy is to be posted to Kennedy & Donkin so that they are received not later than 10th January, 1955, except for Specification NJ.2, which shall not be later than 31st January, 1955.

The Corporation do not undertake to accept the lowest or any tender.

The Engineers for the whole of the work will be Messrs. Kennedy & Donkin, Alliance House, 12, Caxton Street, London, S.W.1.

MAYOR OF NABLUS,
Hashemite Kingdom of Jordan.

6100

GOVERNMENT OF KUWAIT

Department of Electricity, Power Station "B"

TENDERS are invited for the supply of 4 10,000-kW (or nearest standard size of between 8,000 and 12,000 kW) Gas Turbine-driven Alternators and Auxiliaries for the above new power station.

The tender documents will be available in Kuwait on the 29th November, 1954. A single copy of the tender documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti agents. The necessary additional copies of the tender documents will be issued by the Consulting Engineers in London on receipt of the authorisation form from the Government of Kuwait.

Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on the 22nd November, 1954. The tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by the 1st February, 1955.

EWBANK & PARTNERS LTD.,
Engineering Consultants.

10/11, Grosvenor Place,
London, S.W.1. 6080

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

Garry Project: Cabling, Electric Lighting, Heating and other Subsidiary Services at Quoich and Invergarry Compensation Water Generating Stations

TENDERS are invited for the above installations. Copies of the tender document may be obtained on application, with cheque for two guineas (returnable), to the Engineers, Messrs. Kennedy & Donkin, 12, Caxton Street, London, S.W.1.

The Board do not bind themselves to accept the lowest or any tender.

W. D. D. FENTON,
Secretary.

16, Rothesay Terrace,
Edinburgh, 3. 6144

GOVERNMENT OF KUWAIT

Department of Electricity, Power Station "B"

TENDERS are invited for the supply of 4 10,000-kW Steam Turbine-driven Alternators and Auxiliaries for the above new power station.

The tender documents will be available in Kuwait on the 29th November, 1954. A single copy of the tender documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti agents. The necessary additional copies of the tender documents will be issued by the Consulting Engineers in London on receipt of the authorisation form from the Government of Kuwait.

Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on the 22nd November, 1954. The tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by the 1st February, 1955.

EWBANK & PARTNERS LTD.,
Engineering Consultants.

10/11, Grosvenor Place,
London, S.W.1. 6081

BOROUGH OF DORCHESTER

Street Lighting

TENDERS are invited for the supply of electrical equipment and for the installation of 63 Mercury Discharge Lighting Units on concrete and steel columns on Trunk Road No. 37 (A.35). The work includes the removal of the existing lighting equipment.

The general conditions, specifications, bills of quantities and drawings may be inspected at the office of, and copies of the specifications, bills of quantities and form of tender may be obtained on payment of a deposit of £1 1s. (returnable on receipt of a bona fide tender) from, the Borough Engineer and Surveyor, Municipal Offices, North Square, Dorchester.

Tenders, in plain sealed envelopes, endorsed "Street Lighting," must be received by the undersigned not later than noon on Thursday, 23rd December, 1954.

The Council do not bind themselves to accept the lowest or any tender.

F. P. LAKE SYDENHAM,
Town Clerk.
6153

COUNTY COUNCIL OF THE COUNTY OF STIRLING

Bannockburn and District Special Lighting District

Edinburgh-Perth Trunk Road A.9

THE County Council propose to proceed with a new Street Lighting installation in Bannockburn on approximately 1,820 lineal yards of the above road.

The work includes the supply and erection of 40 Reinforced Concrete Lamp Columns, Brackets, Lanterns and Sodium Vapour Lamps.

Contractors desirous of tendering for the above work are requested to inform the undersigned within seven days from the date of publication of this advertisement.

JAMES D. KENNEDY,
County Clerk.
County Offices,
Viewforth, Stirling. 6126

RURAL DISTRICT OF TIVERTON

Street Lighting, Cullompton: Exeter-Leeds Trunk Road, A.38

TENDERS are invited for the installation of Mercury Discharge Class A Lighting, including the supply and erection of columns, brackets and auxiliary control gear.

Plans, specifications and forms of tender may be obtained on application to the undersigned.

Tenders enclosed in a plain sealed envelope and endorsed "Street Lighting" must be delivered to the undersigned not later than 12 noon on Friday, 10th December, 1954.

The Council do not bind themselves to accept the lowest or any tender.

R. L. PUGSLEY,
Clerk.
The Great House,
St. Peter Street,
Honiton, Devon.
8th November, 1954. 6084

BOROUGH OF MORLEY

Street Lighting, A.650

TENDERS are invited for the supply and installation of 42 140-watt Sodium Lighting Units on Trunk Road A.650.

The works are divided as follows:—

Part A. Supply of Electrical Equipment (lanterns, lamps, control gear and time-switches).

Part B. Supply and Erection of Columns, together with fitting and wiring of electrical equipment offered in Part A.

Part C. Supply and Erection of Columns, together with fitting and wiring of electrical equipment provided by another firm.

Offers may be made for separate parts or all parts.

Specifications and forms of tender, upon payment of a deposit of 10s. 6d., which will be refunded after the receipt of bona fide tenders, will be supplied by the Street Lighting Superintendent, Town Hall, Morley, to whom completed forms should be returned not later than 3rd December, 1954.

E. V. FINNIGAN,
Town Clerk.
Town Hall,
Morley, Yorks. 6154

GOVERNMENT OF KUWAIT

Department of Electricity, Power Station "B"

TENDERS are invited for the supply of 4 125,000 lb./hr. Steam Raising Units and Auxiliaries for the above new power station.

The tender documents will be available in Kuwait on the 29th November, 1954. A single copy of the tender documents must be obtained from the President of the Department of Electricity, Government of Kuwait, Kuwait, Persian Gulf, and will only be available to recognised and accredited Kuwaiti agents. The necessary additional copies of the tender documents will be issued by the Consulting Engineers in London on receipt of the authorisation form from the Government of Kuwait.

Notice of the foregoing will be posted on the notice board of the Department of Electricity in Kuwait on the 22nd November, 1954. The tenders to be submitted to the President of the Department of Electricity, Kuwait, Persian Gulf, by the 1st February, 1955.

EWBANK & PARTNERS LTD.,
Engineering Consultants.

10/11, Grosvenor Place,
London, S.W.1. 6082

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the Local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order, 1952.

ROYAL TECHNICAL COLLEGE, SALFORD

Principal: P. F. R. Venables, Ph.D., B.Sc., F.R.I.C.

APPLICATIONS are invited for appointment to the post of ASSISTANT LECTURER GRADE B in the ELECTRICAL ENGINEERING DEPARTMENT. The successful candidate will be required to assist in the lecture and laboratory courses in the field of Electronics and Telecommunications, as provided for the Degree, Higher National Diploma, Higher National Certificate, City & Guilds Telecommunications Engineering Certificate and Radio and Television Servicing Certificates.

Candidates should have good qualifications in electrical engineering and suitable practical, industrial and teaching experience.

The salary will be in accordance with the Burnham Technical Scale, 1954, for Assistant Lecturers Grade B, i.e., £525 × £25 to £820 plus graduate and training allowances.

Forms of application and further particulars of the appointment may be obtained from the Principal, Royal Technical College, Salford, to whom forms should be returned as soon as possible.

R. RIBBLESDALE THORNTON,
Clerk to the Governors.
8th November, 1954. 6103

NORTH WESTERN ELECTRICITY BOARD

APPOINTMENT of:—

(a) GENERAL ASSISTANT ENGINEER (APPLIANCE TESTING),

(b) GENERAL ASSISTANT ENGINEER (WORKSHOP SUPERVISOR),

in the DOMESTIC APPLIANCE WORKSHOP, WALKDEN.

Applicants for post (a) should have experience of routine and type testing and be capable of preparing reports dealing with the construction and performance of all types of electrical appliances.

Applicants for post (b) should have experience of supervising the mechanical and electrical repair and overhaul of all types of electrical appliances, and experience of machine tools and general workshop equipment.

Applicants for either post should be in possession of at least the O.N.C. in Electrical Engineering.

Salary scale £616/£646 p.a., Grade L.13. N.J.B. conditions.

Appointment of SENIOR DRAUGHTSMAN, SUB-AREA MAINS ENGINEER'S DEPARTMENT, BOLTON. Applicants should have experience in the preparation of plans for new and existing buildings, layout of indoor and outdoor substations up to 33 kV, overhead line design, and the preparation of schematic and protective system diagrams.

Possession of H.N.C. in Electrical Engineering or equivalent will be an advantage.

Salary scale £567/£671 p.a., Schedule D, Grade 5. N.J.B. conditions.

Applications for the above posts to the Sub-Area Manager, No. 2 Sub-Area, North Western Electricity Board, National Buildings, St. Mary's Parsonage, Manchester, 3, by 27th November, 1954.

Appointment of GENERAL ASSISTANT ENGINEER (TESTING ASSISTANT), SUB-AREA TESTING STATION, STALYBRIDGE. Applicants would be required to work as necessary throughout the Sub-Area and should have had experience in the testing and installation of industrial metering equipments, the testing of instruments (including standardisation), protective gear equipment, high-voltage testing of cables, transformers and switchgear, and should be qualified to H.N.C. standard in electrical engineering.

Salary scale £583/£605 p.a., Grade K.13. N.J.B. conditions.

Applications to Sub-Area Manager, No. 3 Sub-Area, North Western Electricity Board, Union Street, Oldham, by 27th November, 1954.

Appointment of GENERAL ASSISTANT DISTRICT COMMERCIAL ENGINEER, WHITEHAVEN DISTRICT. The successful applicant will be required to assist in the preparation of estimates and in the supervision of contract work for commercial, industrial and street lighting schemes. Experience in agricultural applications of electricity would be an advantage. H.N.C. standard of education is desirable.

Salary scale £466/£486 p.a., Grade F.13. N.J.B. conditions.

Applications to Sub-Area Manager, No. 6 Sub-Area, North Western Electricity Board, Castle Green, Kendal, by 27th November, 1954. 6147

INSTRUCTOR IN GENERAL ELECTRICAL ENGINEERING

required by the MOMBASA INSTITUTE OF MUSLIM EDUCATION, KENYA, for one tour of 3 years in the first instance with prospect of further employment by mutual agreement. Salary scale (including present temporary allowance of £165/£300 a year) £715 rising to £1,325 a year. Commencing salary according to age, qualifications and experience. Outfit allowance £30. Contributory superannuation scheme. Free passage and free furnished quarters. Liberal leave on full salary.

Candidates should have served an appropriate apprenticeship and have wide subsequent practical experience, including outside wireman's work. They must be capable of instructing in all forms of general electrical engineering, both in theory and in practice, and should hold a C. & G. Certificate or equivalent qualification.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/30683/EF. 6127

BRITISH ELECTRICITY AUTHORITY

London Division

APPLICATIONS are invited for the following superannuable posts. Conditions of service in accordance with N.J.B. Agreement, Schedule A or C. Salary includes London allowance. Qualifications entitling to Graduate Membership of the I.E.E. or I.Mech.E. for posts (a) and Corporate Membership for post (b) an advantage.

(b) STATION SUPERINTENDENT, BECKENHAM GENERATING STATION (Vacancy No. 54/950). Candidates must possess good administrative, organising and managerial abilities. Practical and technical training with power station operation and maintenance experience is essential. Salary Class B, Grade 1 = £919 16s. p.a.

(a) ASSISTANT SHIFT CHARGE ENGINEER, HACKNEY GENERATING STATION (Vacancy No. 54/951). Experience necessary on modern boiler and turbine plant, P.F. and stoker-fired boilers and E.H.T. switchgear. Salary Class H, Grade 9 = £714 p.a.

(a) STATION SHIFT CONTROL ENGINEERS:—

(1) BANKSIDE GENERATING STATION (Vacancy No. 54/952).

(2) HACKNEY GENERATING STATION (5 vacancies) (Vacancy No. 54/953).

Sound engineering training with some experience in control and operation of steam generating plant and main switchgear in modern power station. Salary Class H, Grade 10 = £673 1s. per annum.

(a) ASSISTANT APPRENTICE INSTRUCTOR, BASIC TRAINING WORKSHOP at BANKSIDE, LONDON, S.E.1 (Vacancy No. 54/954). Applicants should have sound practical and technical training in mechanical engineering with workshop experience in blacksmithing and welding. They will be required to carry out instruction in the basic mechanical engineering skills to enable the apprentices to acquire the elements of blacksmith's and welder's techniques. Ability to assist with machine tool demonstration an added advantage. Salary Class AX/EX, Grade 8, in scale £526 1s. to £749 11s. p.a., with starting point according to qualifications.

Applications, quoting vacancy number, may be made on form obtainable from Divisional Secretary, British Electricity Authority, London Division, P.O. Box 136, Generation House, Great Portland Street, London, W.1, and be received within 14 days of this advertisement. 6146

SOUTHERN ELECTRICITY BOARD

Assistant Engineer (Planning)

ISLE OF WIGHT District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class E, Grade 10 (£555-£562-£569 per annum). N.J.B. conditions of service.

The duties of the post will be to assist the planning engineer in the preparation of schemes and estimates for extensions of and reinforcement to overhead and underground H.V. and L.V. networks, and will be required to undertake standby duties if required. The possession of suitable technical qualifications will be an advantage.

Assistant Engineer (Maintenance and Operation)

Aldershot District of No. 3 (Portsmouth) Sub-Area. Salary N.J.B. Class F, Grade 12, Column 1 (£507 per annum.) N.J.B. conditions of service.

The duties of the post will be to assist generally with the operation and maintenance of the H.V. and L.V. overhead and underground distribution systems working at voltages up to 33,000. The qualifications are sound technical training and experience; preference will be given to those applicants who possess technical qualifications up to A.M.I.E.E. standard. The appointment will involve standby duties.

The successful candidates will be required to contribute to the B.E.A. and Area Boards Superannuation Scheme, if eligible.

Applications for the above appointments should be made on forms obtainable from the Sub-Area Secretary, Lower Drayton Lane, Cosham, Portsmouth, and returned to him in envelopes suitably endorsed not later than 3rd December, 1954. 6163

YORKSHIRE ELECTRICITY BOARD

No. 6 (Hull) Sub-Area

BRIDLINGTON DISTRICT.

DISTRICT ENGINEER. Applicants should be Corporate Members of the Institution of Electrical Engineers or possess equivalent qualifications. They must be widely experienced in all branches of electricity distribution work covering industrial, urban and rural areas with underground and overhead systems.

Salary N.J.B. Class D, Grade 3, £813/£843 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 6 (Hull) Sub-Area, Yorkshire Electricity Board, Ferensway, Kingston-upon-Hull, not later than 2nd December, 1954.

No. 1 (Bradford) Sub-Area

BRADFORD DISTRICT.

GENERAL ASSISTANT DISTRICT ENGINEER. Applicants should have passed the Graduateship Examination of the Institution of Electrical Engineers or hold equivalent technical qualifications; they should have experience in construction, operation and maintenance of high-voltage systems, underground cables, overhead lines and substations, and medium and low-voltage networks.

Candidates must be prepared to reside within the District and undertake standby duties, if required.

Salary N.J.B. Class J, Grade 11, £639/£665 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 1 (Bradford) Sub-Area, Yorkshire Electricity Board, 45-53, Sunbridge Road, Bradford, not later than 2nd December, 1954.

No. 3 (Sheffield) Sub-Area

MEXBOROUGH DISTRICT.

LINESMEN (Overhead Power) required to carry out all work in connection with the erection and maintenance of overhead transmission, distribution service and street lighting lines, and any equipment or apparatus in connection therewith.

Rate of pay 3s. 7d. per hour, 44-hour, 5-day week. N.J.I.C. conditions of service.

Applications, giving full details of age, qualifications and experience, should be forwarded to the Manager, No. 3 (Sheffield) Sub-Area, Yorkshire Electricity Board, Commercial St., Sheffield, not later than 2nd December, 1954. 6132

BRITISH ELECTRICITY AUTHORITY

Eastern Division

APPLICATIONS are invited for the following posts:—

THIRD ASSISTANT ENGINEER (Civil & Mechanical), TRANSMISSION DEPARTMENT, at DIVISIONAL HEADQUARTERS. Salary Class AX/DX, Grade 5, £649-£858 per annum plus London weighting.

Applicants should have received training in civil and mechanical engineering and should have preferably qualified for Associate Membership of the Institution of Civil, Mechanical or Structural Engineers.

Applicants should also have had experience in (1) the design and setting out of site works, (2) foundations for buildings and heavy plant, (3) the construction of electrical transmission lines on lattice steel towers.

GENERAL ASSISTANT ENGINEER, TECHNICAL (ELECTRICAL) DEPT., at LUTON. Salary Class AX/DX, Grade 8, £501-£694 per annum.

The duties include assisting in the commissioning and maintenance of protective gear and electrical plant in transforming and generating stations. The appointment will provide a basis for promotion to a higher technical grade, and applicants should possess qualifications of Graduate I.E.E. standard.

Forms of application may be obtained from the Authority's Headquarters, or from any Divisional Office of the Authority, and should be addressed to the Controller, British Electricity Authority, Eastern Division, Northmet House, Southgate, London, N.14, to arrive by 4th December, 1954.

W. N. C. CLINCH,
Controller. 6131

BRITISH ELECTRICITY AUTHORITY

Southern Division

APPLICATIONS are invited for the following positions:—

ENGINEER (Grade 10), POOLE GENERATING STATION (S/13.586). The successful candidate may be called upon to perform the duties of a Station Shift Control Engineer, to assist on maintenance work, or to perform general station duties. Operating experience of modern generating station plant is essential.

Applicants should have had a sound technical training and should possess qualifications leading to Corporate Membership of an appropriate professional institution.

Salary N.J.B. H/10, £641-£667.

ENGINEER (Grade 9) and SHIFT CONTROL ENGINEER, SOUTHAMPTON GENERATING STATION (S/13.587 and S/13.588). The grade 9 engineer may be required to undertake duties in either the boiler house or turbine room.

Applicants should have had appropriate previous experience in a modern generating station, and manufacturing works experience will be an advantage. Preference will be given to those who either possess qualifications and experience leading to Corporate Membership of a recognised professional institution, or who are studying for the examinations of such an institution.

Salary: Grade 9 Engineer: N.J.B. F/9, £607-£629.
Control Engineer: N.J.B. F/10, £577-£598.

GENERAL ASSISTANT ENGINEER, Transmission Department, Portsmouth (S/13.589). Applicants should have had experience in the operation and maintenance of a high voltage system and preferably should have received a works training on high voltage switchgear and transformers. Candidates should possess a Higher National Certificate, or its equivalent, and possession of qualifications leading to Corporate Membership of an appropriate professional institution will be an advantage.

Salary N.J.B. AX/CX 8, £501-£675.

Special application forms for each of the above positions, obtainable from P. D. A. Oliver, Divisional Secretary, 111, High Street, Portsmouth, should be returned by 1st December. Please quote ref. E.R. 6158

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

ASSISTANT MAINTENANCE ENGINEER (Mechanical), DRAKELOW POWER STATION (Vacancy No. 176/54/ER). Previous operation and maintenance experience with modern high pressure plant, with technical qualifications up to H.N.C. standard essential.

Salary in accordance with Class J, Grade 8 (£764-£796 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 25th November, 1954.

THIS AMENDED ADVERTISEMENT REPLACES Vacancy No. 164/54.

ASSISTANT MAINTENANCE ENGINEER (Electrical), DRAKELOW POWER STATION (Vacancy No. 177/54/ER). Previous operation and maintenance experience with all types of electrical plant in a modern power station, with technical qualifications up to H.N.C. standard as a minimum requirement.

Salary in accordance with Class J, Grade 8 (£764-£796 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications 25th November, 1954.

THIS AMENDED ADVERTISEMENT REPLACES Vacancy No. 165/54.

These appointments will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O.Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote vacancy number.

L. F. JEFFREY,
Divisional Controller. 6160

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments.

Norfolk Sub-Area

SUB-AREA HEADQUARTERS, NORWICH (146/54.R.), PRINCIPAL ASSISTANT (Salaries, Wages and Superannuation). Candidates should possess a wide experience of salaries and wages systems, including mechanised methods, and superannuation, pay-roll and personnel records. They should also be conversant with wage award procedure and used to the interpretation and application of agreements.

Salary will be in accordance with Grade 6 (£730 × £25 to £805) of the National Joint Council Salary Agreement.

Apply to the Manager, Norfolk Sub-Area, Eastern Electricity Board, 4, Duke Street, Norwich, Norfolk.

Northmet Sub-Area

ST. ALBANS & WELWYN GARDEN CITY DISTRICT (163/54.R.), SALES REPRESENTATIVE. The duties will include advising consumers on commercial matters associated with supply, tariffs and apparatus sales, in accordance with the National Joint Council Agreement.

Salary will be in accordance with Grade 1 (£400 × £20 to £480 × £10 to £490) of the National Joint Council Salary Agreement.

Apply to the Manager, Northmet Sub-Area, Eastern Electricity Board, Northmet House, Southgate, London, N.14.

Future salary and conditions of service for the above appointments will be in accordance with agreements made from time to time by the appropriate negotiating bodies.

The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Applications, by letter, stating age, education, qualifications and experience with details of present appointment and salary, should be submitted to the Manager concerned within fourteen days of the appearance of this advertisement. 6157

ELECTRICAL TECHNICIANS

as shown below are required by the ZANZIBAR GOVERNMENT for one tour of 2-3 years on contract. Salary scale (including present temporary allowance of £192/£257 a year) £782 rising to £1,097 a year. Commencing salary according to qualifications and experience. Gratuity of 13½% of total basic salary drawn during contract. Outfit allowance up to £60. Free passages. Liberal leave on full salary.

(A) INSTRUMENT MECHANIC (M2A/30676/EF). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent, with not less than 3 years' experience in the meter department of a supply undertaking or meter manufacturer's works. They should be able to carry out repairs to single and polyphase house service meters and switchboard instruments.

(B) ARMATURE WINDER (M2A/30678/EF). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent, with not less than 5 years' experience in the winding of A.C. and D.C. machines up to 11 kV. They should be capable of rewinding a 1,000-kVA, 11,000-volt alternator stator.

(C) PLUMBER-JOINTER (M2A/30679/EF). Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent, with not less than 5 years' experience in the jointing of cables up to 11 kV.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote reference number of appointment applied for. 6087

METROPOLITAN-VICKERS ELEC. CO. LTD.

require DESIGN DRAUGHTSMEN for METALCLAD AND HIGH-VOLTAGE SWITCHGEAR DEVELOPMENT. Senior and Junior positions available according to experience.

Applications giving details of experience, age, etc., should be addressed to the Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17. 216

THE BRITISH THOMSON-HOUSTON COMPANY LIMITED

has vacancies on its Design and Development staffs at Rugby, Birmingham, Coventry, Leicester and Newcastle-under-Lyme, for ELECTRICAL AND MECHANICAL ENGINEERS with experience in the following fields:—

INDUSTRIAL ELECTRONICS (all modern applications of electronics).

ELECTRICAL MACHINE DESIGN (A.C. and D.C., large, intermediate and fractional h.p. sizes).

INDUSTRIAL APPLICATION OF ELECTRICAL EQUIPMENT (steel works, mining, paper mills, machine tools and other industries).

TRANSFORMER DESIGN (large E.H.T., intermediate and small).

AIRCRAFT ELECTRICAL EQUIPMENT (A.C. and D.C. generators, motors, contactors, starters, etc.).

The openings provide good prospects for young men with technical ability and education in a large rapidly growing industry with ample opportunities for gaining experience in new fields. Young men with honours engineering or science degrees or their equivalents, and engineers with practical mechanical design experience on the drawing board, are required.

Applications should be made to the Chief Electrical Engineer's Department, The British Thomson-Houston Company Ltd., Rugby, together with particulars of technical qualifications, training and experience. 5827

ELECTRICAL ENGINEER

THE Chief Architect of a large retail organisation requires a qualified ELECTRICAL ENGINEER to advise him on the design, installation and general work concerning the lighting of shops. The ability to put forward progressive schemes on own initiative and develop ideas regarding the economics of internal and external lighting is of great importance. Experience of contemporary lighting is of more advantage than the normal practice adopted by the average retailer.

As this is a senior appointment, only those with outstanding ability will be considered.

Salary will be not less than £1,500, and can be increased to £2,000 per annum or higher if necessary. The post is pensionable, therefore age must not be over 45.

Applications, by letter only, giving full details of experience and present salary should be addressed to:—

The Secretary
THE PROFESSIONAL ENGINEERS APPOINTMENTS BUREAU
9, Victoria Street, Westminster, London, S.W.1

6085

TECHNICAL SALES STAFF FOR SOUTH AFRICA

(1) TECHNICAL SALES ENGINEER. Candidates should have a technical background preferably not less than Higher National Certificate level, and experience in tendering for switchgear up to 33,000 volts.

(2) TECHNICAL SALES PROMOTION ENGINEER. Candidates should have a sound technical background, a pleasing personality, and experience of representation with buyers and consultants. Candidate will operate from Johannesburg, but may be expected to travel in the northern part of the Union of South Africa, although most of his contacts will be in and around Johannesburg.

These appointments are for permanent situations at switchgear works in South Africa where switchgear up to 11,000 volts is manufactured and enquiries for gear up to 66,000 volts are handled. Preference will be given to men between 28 and 38 years of age. Salaries will be in accordance with qualifications and experience, and good bonus and life assurance schemes are in force.—Box 6089.

COUNTY BOROUGH OF DONCASTER

Borough Surveyor and Water Engineer's Department

Appointment of Building Works Assistant

APPLICATIONS are invited for the appointment of a BUILDING WORKS ASSISTANT at a commencing salary of £600 rising to £725 by increments of £25.

Candidates must be experienced in electrical engineering works, and be efficient draughtsmen capable of preparing schemes and estimates for electrical installations. Previous experience in street lighting schemes will be considered an advantage, and candidates should hold suitable electrical engineering qualifications.

Applications, stating age, qualifications and experience, together with the names and addresses of three referees, should reach the Borough Surveyor and Water Engineer, 2, Priory Place, Doncaster, not later than Wednesday, 24th November, 1954.

Candidates must state in their application whether to their knowledge they are related to any member or senior officer of the Council.

The appointment is terminable by one month's notice, and is subject to the provisions of the Local Government Superannuation Act, 1937, and to the person appointed passing a medical examination.

H. R. WORMALD,
1, Priory Place, Town Clerk.
Doncaster. 6130

BRITISH ELECTRICITY AUTHORITY

East Midlands Division

APPLICATIONS are invited for the position of GENERAL ASSISTANT ENGINEER in the TRANSMISSION DEPARTMENT at this Divisional Headquarters.

Applicants should have experience in the manufacture, design or installation of high voltage transmission equipment and should preferably be a Graduate Member of the Institution of Electrical Engineers.

Salary will be within Class AX/DX, Grade 8 (£501-£694 per annum) of the National Joint Board Agreement.

This appointment will be pensionable within the terms and provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Closing date for receipt of applications 2nd December, 1954.

Applications should be submitted on the official form A.E.6/ACT, which may be obtained from the Divisional Establishments Officer, British Electricity Authority, P.O. Box 25, Barker Gate, Nottingham, and should be returned to the undersigned by the date stated. Please quote Vacancy Number 175/54/ER.

L. F. JEFFREY,
Divisional Controller. 6161

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD

APPLICATIONS are invited for the following appointments:—

(1) GENERATION ENGINEER, Fort Augustus Area, whose duties will include the operation and maintenance of Hydro-Electric Generating Stations in Glen Garry and Glen Moriston and a 132-kV switching and transforming station.

(2) GENERATION ENGINEER, Killin Area, whose duties will include the operation and maintenance of the Finlarig Hydro-Electric Generating Station, 132-kV switching and transforming station and subsequently perhaps of hydro stations in Glen Lochay and Glen Lyon now under construction.

Applicants for the above posts must have sound technical qualifications and have had experience in the operation and maintenance of generating plant, auxiliary plant and switchgear. The salaries will be in accordance with qualifications and experience and subject to adjustment by the appropriate negotiating machinery. Superannuation scheme applicable.

Application form obtainable from the Secretary, 16, Rothesay Terrace, Edinburgh, 3, must be returned within 14 days from the date of this advertisement. 6113

LONDON ELECTRICITY BOARD

Demonstrators

APPLICATIONS are invited for the above positions in the Greenwich, Beckenham/Bromley and Bermondsey Districts of the Southern Sub-Area.

Applicants should be suitably qualified, holding the E.A.W. or other approved certificate, including electrical housecraft, and have experience in conducting demonstrations at service centres and in general service centre duties. They should also be experienced in advising consumers on the selection and use of domestic appliances, both at the service centre and on consumers' premises.

The posts are graded within the National Joint Council Agreement (Administrative and Clerical Grades) as Grade 1, i.e., £400 to £490 per annum, plus the appropriate London area allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed within 10 days of the publication date of this advertisement. Please enclosed addressed envelope and quote ref. V/1803/R. 6133

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD. LIVERPOOL, 7

Draughtsmen

THE expanding programme of the Transmission Department offers vacancies in both senior and junior categories for Draughtsmen with experience in telecommunications or light current engineering.

Positions offered are on the company staff with contributory pension fund and usual staff conditions.

Applicants should write to Personnel Manager, Automatic Telephone & Electric Co. Ltd., Strowger Works, Edge Lane, Liverpool, 7, giving full details of age, qualifications and experience. 208

THE UNIVERSITY OF MANCHESTER

APPLICATIONS are invited for the following appointments in the DEPARTMENT OF ELECTRICAL ENGINEERING:—SENIOR LECTURER, LECTURER, and ASSISTANT LECTURER.

Candidates should have experience in one or more of the following fields: High Voltage, Electrical Machines, Electronics. One of the persons appointed will be required to take charge of a new High Voltage Laboratory operating up to 1 million volts D.C. and impulse.

Salary scales per annum: Senior Lecturer, £1,150 to £1,500; Lecturer, £500 to £1,100; Assistant Lecturer, £450 to £550. Membership of F.S.S.U. and children's allowance scheme.

Applications should be sent not later than 30th November, 1954, to the Registrar, The University, Manchester, 13, from whom further particulars and forms of application may be obtained. 6002

TRAINING OFFICER

required for the ELECTRICITY DEPARTMENT, GOLD COAST LOCAL CIVIL SERVICE for two tours of 18 to 24 months on contract. Consolidated salary scale £1,330 rising to £1,680 a year. Gratuity at the rate of £150 a year. Outfit allowance up to £60. Free passages. Liberal leave on full salary.

Candidates, over 28, should have served a recognised apprenticeship in mechanical or electrical engineering and have had at least 3 years' experience in the operation of modern technical training schemes. Preference will be given to candidates holding H.N.C. in Mechanical or Electrical Engineering or O.N.C. in Mechanical and Electrical Engineering or similar qualifications.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/40525/EF. 6110

BRITISH ELECTRICITY AUTHORITY

Midlands Division

Appointment of Establishments Officer

APPLICATIONS are invited for the position of ESTABLISHMENTS OFFICER, Midlands Division, at a salary within the scale of Principal Assistant, £1,000 × £40 to £1,120 per annum. The post is superannuable under the provisions of the British Electricity Authority and Area Boards Superannuation Scheme.

Candidates must have had a sound general education, possess good organising ability, and have had experience of negotiation and joint consultation work either in the electricity supply industry or in a large industrial concern. The possession of a recognised professional qualification will be considered an advantage.

Applications should be forwarded to the Divisional Secretary, 53, Wake Green Road, Moseley, Birmingham, 13, not later than 29th November, 1954. 6145

AIRCRAFT ELECTRICAL AND ELECTRONIC ENGINEERING

APPLICATIONS are invited for Senior Superannuated Staff appointments in the Design Dept. from men who have good degrees (preferably First Class Honours) in Electrical Engineering and the experience necessary to justify the payment of good commencing salaries.

Write fully, stating salary expected, in first instance to the

Personnel Supervisor
HAWKER AIRCRAFT LTD.
Canbury Park Road
Kingston-on-Thames, Surrey

6148

ASSISTANT LECTURER (ELECTRICAL ENGINEERING)

required for the EDUCATION DEPARTMENT, NIGERIA, for two tours of 18 to 24 months or three tours of 10 to 12 months in the first instance. Option of appointment either (a) on agreement with prospect of permanency with salary in scale (including expatriation pay) £750 rising to £1,315 a year or (b) on contract with salary in scale (including expatriation pay) £807 rising to £1,453 a year plus gratuity at the rate of £100/£150 a year. Outfit allowance £60. Free passages for the officer and wife. Assistance towards cost of children's passages or grant up to £150 annually for maintenance in U.K.

Candidates should hold the H.N.C. in Electrical Engineering or equivalent qualification and have had previous teaching and industrial experience.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2A/30630/EF. 6111

SURREY COUNTY COUNCIL

APPLICATIONS are invited for appointment of ASSISTANT ELECTRICAL ENGINEER, Grade V, salary £620 × £15/£20 to £670 p.a. plus London weighting. Applicants should be experienced in preparation of schemes, specifications, drawings and estimates for, and supervision of, installations of electrical services in buildings.

Applications, giving full details of present and previous appointments and salary attaching thereto, accompanied by copies of 3 recent testimonials, to County Architect, County Hall, Kingston, by 27th November, 1954. 6102

SENIOR DEVELOPMENT ENGINEER

having experience in the design and manufacture of fractional horsepower and fan induction motors is required by progressive firm for design office in central Glasgow. Applications are invited in strictest confidence. Assistance will be given for suitable applicants requiring housing accommodation. Conditions include 5-day week and pension and life assurance scheme. Apply giving details of age and experience, qualifications and salary to—Box 6050.

LONDON ELECTRICITY BOARD

Engineering Draughtsman

APPLICATIONS are invited for the above positions in the Design and Planning Branch of the North Western Sub-Area in Central London.

Applicants should have had a good general and technical education in electrical engineering and building construction, and experience in a mains records office dealing with systems of all voltages up to 11 kV.

The post is graded under Schedule D of the National Joint Board Agreement as Grade 6, £458 to £595 7s. per annum, inclusive of London allowance.

Application forms obtainable from Personnel Officer, 46, New Broad Street, London, E.C.2, to be returned completed by 30th November, 1954. Please enclose addressed envelope and quote ref. V/1820/R on envelope and all correspondence. 6101

THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

Fort Halstead, Kent

ELECTRICAL ENGINEER/PHYSICIST required in the grade of SENIOR EXPERIMENTAL OFFICER to assist in research and development on problems associated with high voltage, high energy electrical discharges.

Applicants should be at least 35 years of age and have a Higher School Certificate (Science) as a minimum qualification, possession of a degree or Higher National Certificate in Electrical Engineering or Physics is desirable. A good basic understanding of electronics and practical experience of the generation of high voltage pulses and the measurement of very short time intervals would be an advantage. The salary scale is £982-£1,162 per annum (male).

Application form from Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks. Quote ref. 299/WGE/48. 6112

ELECTRICAL ENGINEERS

A WELL-known industrial organisation has vacancies for Electrical Engineers. First-class men, able and willing to shoulder responsibility, are sought, and there are excellent opportunities for advancement. Vacancies exist for men with experience in either power distribution or instrumentation. For the latter type of vacancy applications from physicists will be welcomed. Starting salaries in the range £600-£900 p.a. depending upon qualifications and experience. Postgraduate training leading to professional qualifications can be arranged, and normal salaries will be paid during such training. Candidates should hold an honours degree.

Write, giving full details of age, qualifications and experience, and quoting Ref. U.7, to—Box 5964.

AN INTERNATIONAL LIGHT ENGINEERING COMPANY

in West London has a vacancy for a SENIOR ENGINEER to develop specialised magnetic recording heads. Applicants must have development and production experience on magnetic recording equipment, and be qualified to exploit new materials and methods of manufacture. Preference will be given to applicants with metallurgy qualifications. The post is pensionable and the salary will be commensurate with ability.—Box 6135.

PRODUCTION ENGINEER

required by a prominent group with electrical and mechanical subsidiaries in the North West of England. This is a senior appointment and candidates must have had a wide experience in design considerations in relation to repetitive production, preferably in the electrical industry.

The position is permanent and pensionable with a starting salary of not less than £2,000 p.a. with considerable opportunity for further advancement.

Please apply giving full details of age, education, training, and experience, to Box 2J. L5128, A.K. Advertising, 212a, Shaftesbury Avenue, London, W.C.2. 6048

NORTH EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments:—
WEAR SUB-AREA, DEMONSTRATOR with location at Chester-le-Street District.
TEES SUB-AREA, DEMONSTRATOR with location at Redcar Service Centre.

Applicants should have a certificate of a recognised domestic science training college and/or E.A.W. certificate, preferably the latter; also considerable experience as a demonstrator or assistant demonstrator in the electricity supply industry. Salary Grade 1, £400/£490. Annual increments of £20 up to £440; beyond £440, increments subject to certificate of competence. N.J.C. conditions of service.

Applications stating age, qualifications and experience, should be forwarded to the Secretary (Establishments), North Eastern Electricity Board, G.P.O. Box No. 117, Carliol House, Newcastle upon Tyne, 1, within ten days of the appearance of this advertisement. 6165

ADMIRALTY

DRAUGHTSMEN required in Admiralty Research and Development Establishments in London (Teddington area), Bournemouth and Weymouth with experience in any of the following classes of equipment: light to medium electrical, electro-mechanical, precision mechanical and electronic.

Candidates must be British subjects aged 21 years or over, with at least 3 years' practical workshop training besides drawing office experience, and have O.N.C. or equivalent.

Appointments unestablished but opportunities will occur to compete for established posts and for promotion.

Starting pay (London rate) £420 per annum (age 21), £580 (age 28) rising to £670; slightly less in the Provinces.

Apply stating age, training, experience and qualifications to Admiralty (C.E. II, Room 92), Empire Hotel, Bath. 201

COMMUNICATION ENGINEERS AND DRAUGHTSMEN

THE expanding programme of the Transmission Department offers vacancies in both senior and junior categories for LINE TRANSMISSION LABORATORY ENGINEERS and APPARATUS DESIGN ENGINEERS, and also for DRAUGHTSMEN with experience in telecommunications or light current engineering.

Specialist experience in any branch of line transmission engineering is desirable for some of the posts.

Positions offered are on the company staff, with contributory pension fund and usual staff conditions.

Applicants should write to Personnel Manager, Automatic Telephone & Electric Co. Ltd., Strowger Works, Edge Lane, Liverpool, 7, giving full details of age, qualifications and experience. 6008

BRITISH ELECTRICITY AUTHORITY

North West, Merseyside and North Wales Division

VACANCY No. 221/54/R. POWER STATION SUPERINTENDENT at Barton Generating Station, Near Manchester. Salary £1,300/£1,450 (NJM.2). Applicants should be qualified engineers with experience of modern steam power plant. An appreciation of modern concepts of administration, financial control and employee relations is desirable. Closing date 30th Nov.

Vacancy No. 223/54/R. STATION SHIFT CONTROL ENGINEER at Barton Generating Station. Salary £641/£667 (H.10). Closing date 30th Nov.

Apply, quoting vacancy number, to Controller, British Electricity House, 825, Wilmslow Road, Manchester, 20. 6159

THE POWER CENTRE CO. LTD.

Lloyd Street, Wednesbury

Electrical Distribution Gear Specialists, require DESIGNER-DRAUGHTSMAN for development work. Unlimited scope and opportunities. Excellent working conditions. Pension scheme. House accommodation will be considered for applicants not resident in area. Applications by letter. 6104

SOUTH EASTERN ELECTRICITY BOARD

PRINCIPAL ASSISTANT, Secretary's Department, Headquarters.

Salary £805 × £30 to £895 under N.J.C. Agreement, Grade 7. This appointment is within the Organisation and Methods Section and applicants should be interested in and have an aptitude for this kind of work. Possession of a degree or appropriate professional qualification desirable. Experience in the electricity supply industry an advantage. The appointment is subject to the British Electricity Authority and Area Boards Superannuation Scheme.

Applications, naming 2 referees, to A. L. Burnell, F.I.M.T.A., A.A.C.C.A., Secretary, SEEBoard, 10, Queen's Gardens, Hove, 3, Sussex, by 1st December, 1954.

A. L. BURNELL,
Secretary.
6164

CHIEF DESIGNER

required by a group of electrical manufacturing companies in the North of England. This is a senior executive appointment and candidates must have originality, organising ability and drive.

The successful applicant must be capable of building up a design staff ab initio and should preferably have experience in the design of contactors, overload protective devices, etc., and electrical equipment generally.

The position is permanent and pensionable and carries a commencing salary of £2,000 per annum with considerable opportunities for the future.

Please apply giving details of age, education, training and experience, to Box 2J. L5119, A. K. Advertising, 212a, Shaftesbury Avenue, London, W.C.2. 6049

OVERHEAD LINESMAN

required by ZANZIBAR GOVERNMENT for one tour of 2-3 years on contract. Salary scale (including present temporary allowance of £192/£257 a year) £782 rising to £1,097 a year. Commencing salary according to qualifications and experience. Gratuity of 13½% of total basic salary drawn during contract. Outfit allowance up to £60. Free passages. Liberal leave on full salary.

Candidates must have served an apprenticeship and hold the O.N.C. in Electrical Engineering or equivalent, with not less than five years' experience of construction and maintenance of L.T. and 11-kV overhead lines and services.

Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2A/30667/EF. 6128

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD

COMMERCIAL ASSISTANT (Technical required in the Runcorn District. Salary £524/£540 p.a. (N.J.B. E/11). Appointment superannuable and subject to medical examination.

Applicants must have had an engineering training, and preferably have the qualifications necessary to enable them to become chartered electrical engineers.

Standard application forms, which are obtainable from any of the Board's offices, should be completed and forwarded to the Manager, No. 2 Sub-Area, Sandiway House, near Northwich, Cheshire, not later than 29th November, 1954. 6129

BRITISH ELECTRICITY AUTHORITY

Midlands Division

JUNIOR ENGINEER is required at Hams Hall B Power Station. N.J.B. service conditions, superannuable appointment, salary within Schedule A of the Agreement, Grade K15, £545 per annum.

A sound technical education and practical training are required, and preferably some experience within a large modern power station. Appropriate technical qualifications an advantage.

Apply quoting Vacancy No. 821MD, on form AE6, available from the Establishments Officer, 53, Wake Green Road, Moseley, Birmingham, 13, by 4th December, 1954. 6162

BRITISH ELECTRICITY AUTHORITY

South Wales Division

Vacancy No. 109/54

APPLICATIONS invited for superannuable N.J.B. appointment of 1st ASSISTANT STATION CHEMIST, Uskmouth Power Station. Salary K9, £766-£796 per annum.

Degree in Chemistry or equivalent and experience in water treatment, coal and oil testing and corrosion problems desirable.

Application forms obtainable from Secretary, South Wales Division, British Electricity Authority, Twyn-y-Fedwen Road, Gabalfa, Cardiff to be returned by 3rd December, 1954. 6192

THE NATIONAL INSTITUTE FOR RESEARCH IN DAIRYING

Dairy Engineering Department

AN EXPERIMENTAL OFFICER is required for testing of dairy machinery. Applicants should have a degree or equivalent, including applied thermodynamics, to H.N.C. standard and experience of engineering testing work. Experience in the dairy industry is not essential.

Salary scale (men) £690-£850 with F.S.S.U. superannuation. Applications, stating age, present appointment and salary to the Secretary, N.I.R.D., Shinfield, Reading. Quote ref. 54/9. 6088

MUIRHEAD & CO. LTD., BECKENHAM, KENT

Design Draughtsmen

EXPANDING programme offers vacancies for both senior and junior design draughtsmen with experience of light electro-mechanical apparatus.

The work covers a wide range of developments and the positions offer ample scope for persons with initiative and ability. Salary according to qualifications and experience.

Apply by letter, stating details of age, training and experience, to—Personnel Manager. 6054

A PROGRESSIVE position in expanding South-East England company is offered for person experienced in all branches of sales office organisation; able to work with minimum supervision. Electronic or electrical background an asset. Suitably qualified applicants are invited to write, giving details of experience, to—Box Z.906, Willing's, 362, Grays Inn Road, London, W.C.1. 6105

A SENIOR technical designer with first class experience of the design of electrical accessories is required in London by The General Electric Co. Ltd. Wide experience in a works design office is essential, together with the ability and keenness to make a real contribution to the developments of the company's electrical accessories. Applications, giving full details of record and experience, should be addressed to the Staff Manager (Ref. ELS), The General Electric Company Ltd., Magnet House, Kingsway, London, W.C.2. 6114

ALLEN WEST & Co. Ltd., Brighton, 7, require experienced men for their engineering department. Must have had experience with electrical control gear manufacturers and be capable of engineering control schemes involving contactor type gear for all industrial applications. Replies, with technical qualifications and salary required, to—Mr. E. S. Heathcote. 7724

AN attractive career is available to young men of good education and training with the personality required for success in selling rotating electrical machinery up to 1,000 h.p. Necessary qualifications are Ordinary National Certificate in Electrical Engineering and some practical experience in the manufacture, repair or installation of industrial motors and generators. Pension scheme and bonus on results. Applications, giving full details of age, education, training, experience and salary required, to—Higgs Motors Ltd., 109, Kingsway, London, W.C.2. 6009

AN old-established E.W.F. wholesaler has a vacancy at their London branch for a young man to assist in their order department. Applicant should have some knowledge of the electrical trade and should not be afraid of hard work.—Box 6090.

A YOUNG electrical engineering or physics part-time student required by laboratory near S.E. London for interesting development work on power cable and capacitor dielectric materials. Minimum starting salary, according to stage of advancement in studies and amount of time off required for further pursuit of studies, £400 p.a. Post permanent and pensionable. National Service must be completed.—Box 7740.

AN opportunity occurs in progressive manufacturing concern in London area for engineer aged 25/35, with electrical or physicist degree, on development and research work on high-frequency telecommunication cable and associated testing equipment. Salary will be commensurate with qualifications and experience. Apply giving full particulars to—Box 6011

APPLICATIONS are invited for the post of Linesman, on the Island of Mull. Good knowledge in electric power supply and repair maintenance work an essential qualification. Some experience in electrical house wiring systems an advantage. A house is available. National Joint Industrial Council conditions and rates of pay apply. Application forms are available from the Area Manager, North of Scotland Hydro-Electric Board, Municipal Buildings, Oban. 6166

APPLICATIONS are invited from engineers of Inter B.Sc., or Higher National Certificate standard for investigational work on thermionic valves. Five-day week, staff pension scheme, modern welfare amenities. Apply, giving full particulars of age, qualifications and experience, to—Personnel Superintendent, The Edison Swan Electric Co. Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. 6115

APPLICATIONS engineer required for work on electrical design applicable to automatic control gear for mechanical handling plants and similar uses. Must have electrical knowledge to H.N.C. standard. Salary £700/£800 per annum according to age and experience. West Middlesex area. For successful applicant requiring housing accommodation, assistance may be given for skilled and key personnel. Pension scheme, canteen, etc. Write giving full details of age, experience and qualifications to—Box 6194.

ARMATURE winder required, excellent conditions and rates, 20 mins. from Waterloo. —Max Arc & Electrics Ltd., Terrace Road, Walton-on-Thames, Surrey. 170

ARMATURE winders urgently required. Top rates paid for the right men. Apply—Collins Electrical Ltd., 22, St. Albans Place, Upper Street, Islington, London, N.1. 5991

CENTRAL London. Established contractors require first-class estimating engineer capable of taking control and salary commensurate.—Box 7749.

CHEMIST required by a firm of electric cable manufacturers in the North-East area. Experience in rubber cable manufacture preferred but not essential. Superannuation fund and 5-day working week. Reply stating age, experience and salary required to—Box 5994.

CLERK required, male or female, for accounts dept., experienced in checking purchase invoices, etc. Hammersmith district. Good salary. Reply stating full particulars of experience in confidence to—Box 6167.

CONTRACTS engineers required for handling of switchgear tenders and contracts. Applications should state age, experience, qualifications and salary required, and should be addressed to—Personnel Manager, South Wales Switchgear Ltd., Blackwood, Mon. 5997

DEMONSTRATOR (lady) required to assist in the electrical section, The Building Centre, London, W.C.1. Commencing salary £430 p.a. Write giving age and full details of education and experience to — The Director, British Electrical Development Association, 2, Savoy Hill, London, W.C.2. 6168

DESIGN draughtsman. An excellent opportunity occurs with housing assistance available for a first-class designer-draughtsman with experience of light/medium electro-mechanical equipment for development work on battery electric trucks of advanced design. A substantial salary is offered to a man of proved ability. Applicants should be of H.N.C. standard, must have an original outlook, and be capable of taking charge of job from its conception to the production stage. Modern factory in country district 1 hour London. Reply in confidence giving all details to—Box 6106.

DEVELOPMENT engineer required by leading firm of electrical component manufacturers in N.W. London for work in connection with development of printed circuits and application to production. H.N.C. or Inter. B.Sc. standard. Experience of radio and TV technique essential. Superannuation scheme. Write stating full details of education, experience and salary required to Personnel Manager.—Box 6136.

DRAUGHTSMAN required by consulting engineers for the reproduction of electric light and power schemes. Previous experience essential. Write, stating age, experience and salary required, to—E. Wingfield-Bowles and Partners, 32, Old Queen Street, Westminster, London, S.W.1. 157

DRAUGHTSMAN required for preparation of drawings in connection with overhead line contracts. References required. Apply in writing, stating salary required and when available for employment, to—Reference S.L.R., B. French Limited, Pike Mills, Green Street, Kidderminster. 6116

DRAUGHTSMAN required (London, Victoria area) for manufacture of L.T. switchgear and general engineering. Prospects for man with initiative. Write age, experience and salary required.—Box 6056.

DRAUGHTSMAN, senior engineering, capable electrical layouts, required by large London firm engineers. Write age, salary, references.—Box 5870.

DRAUGHTSMEN required for mechanical design of compressed air components. Some mechanical experience essential. Applications giving details of experience, age, etc., should be addressed to—Personnel Manager, Metropolitan-Vickers Elec. Co. Ltd., Trafford Park, Manchester, 17. 217

DRAUGHTSMEN required with transformer experience. Excellent conditions and rates. Permanent and progressive posts. Apply Chief Engineer, Transformers (Watford) Ltd., Sandown Road, Watford. 6169

DRAUGHTSMEN. The English Electric Company Limited, Liverpool works, have vacancies in their switchgear department for draughtsmen with experience of switchgear layout and installation, wiring diagrams, sheet steel cubicles, light fabrications or electro-mechanical mechanisms. Pensionable and progressive positions with excellent opportunities for promotion are offered for men with initiative. Housing assistance will be given to selected applicants and travelling expenses will be paid for interview. Write giving full details of age, qualifications and experience to Dept. C.P.S., 336/7, Strand, London W.C.2, quoting ref. 135J. 6170

ELECTRICAL circuit draughtsman for manufacturer of automatic temperature controls. Permanent pensionable post for man up to 50 years old. Written applications to —DHS, The Rheostatic Company Limited, Slough, Bucks. 5971

ELECTRICAL contractor, old-established, Birmingham, requires estimating and supervising engineer. Experience in good-class commercial and industrial installations; must be capable of supervision to final invoice. Reply in confidence, stating age, experience and salary. —Box 7722.

ELECTRICAL draughtsman required by consulting engineers for work on power and lighting layouts for all types of buildings. Write, stating age, qualifications and salary required, to—J. Roger Preston & Partners, 15, North Audley Street, London, W.1. 6118

ELECTRICAL draughtsman required by Manchester office of consulting engineers for the preparation of all classes of power and lighting layouts. Write, stating age, experience and salary required, to—R. W. Gregory & Partners, Cromford House, Cromford Court, Manchester, 4. 6117

ELECTRICAL draughtsmen (senior and junior) required by the British Thomson-Houston Co. Ltd., Rugby, for their electrical layout drawing office. Should have had experience in the layout of foundations, cabling and heavy busbar connections for power stations and industrial plants. Apply in writing, giving age, experience, etc., to—Manager, Drawing Offices, British Thomson-Houston Co. Ltd., Rugby. 6119

ELECTRICAL engineer to assist in the design of transformers and voltage regulating equipment for well-established company in North London.—Box 6150.

ELECTRICAL designer/draughtsman required with experience in the design of electrical control panels and control circuits for automatic machinery. Good opportunity, good prospects and interesting work for the right man. Pension fund scheme facilities, staff canteen, 5-day week. Please apply stating age and experience to — Projectile & Engineering Co. Ltd., Acre St., Battersea, London, S.W.8. 6092

ELECTRICAL engineer required by reputable company. Must have had wide experience involving the control of men and must have been responsible for the preparation of specifications and the execution of lighting and power contracts, preferably including some cinema or theatre installations. A working knowledge of the regulations governing cinemas and theatres preferable but not absolutely essential. Salary according to experience subject to a minimum of £1,000 per annum. State age and full details of experience to—Box 7750.

ELECTRICAL engineer/draughtsman required for interesting work on large chemical plant installations. Applicants should have some works experience on heavy industry and technical ability to deal with a large variety of problems. Duties include the preparation of power and lighting schemes. Generous salary commensurate with experience and ability. Five-day week and superannuation scheme in force. Applications, which will be treated in confidence, should give previous experience and qualifications and be addressed to—The Chief Draughtsman, Laporte Chemicals Ltd., Clifton House, Euston Road, London, N.W.1. 6172

ELECTRICAL engineering assistant required for work in the Research and Development Department of Bakelite Limited, Birmingham. Applicants should have good basic training together with experience in electronics. National Certificate standard preferred. Applications should be addressed to—Research and Development Director, Bakelite Limited, Redfern Road, Tyseley, Birmingham, 11. 6174

ELECTRICAL engineering inspector required by an Irish insurance company for inspection work in Ireland. State age, experience and qualifications.—Box 6091.

ELECTRICAL engineers of degree or H.N.C. standard and possessing industrial experience on experimental and development work are required for our research and development laboratories. They will be required to work on one or more of the following projects: special ignition apparatus, control systems, small motors and generators, etc. The work is extremely interesting and the prospects are excellent for men with the necessary initiative and technical knowledge. Please reply stating age, qualifications and experience to — Personnel Manager, Joseph Lucas (Electrical) Ltd., Great King Street, Birmingham, quoting reference PM/D/40. 144

ELECTRICAL fitter required for repair, reconditioning and testing electric motors and control gear to 200 h.p. Sound electrical knowledge of this type of work necessary.—John Phillips & Co. Ltd., India Pavilion, Exhibition Grounds, Wembley, Middx. 6173

ELECTRICAL fitters required. Top rates paid for the right men. Apply—Collins Electrical Ltd., 22, St. Albans Place, Upper Street, Islington, London, N.1. 5992

ELECTRICAL wholesaler requires the following additional staff: Order clerk, also pricing clerk; knowledge of trade essential. Storesman with good knowledge of electrical equipment.—London Electrical Co., 92, Blackfriars Road, London, S.E.1. 5871

ELLIOTT BROS. (LONDON) Ltd. invite applications for appointment as sales and contract engineer in their electrical measuring instrument division. Electrical engineering background to H.N.C. level and experience of quotation work in industry desirable. Applications in confidence to—The Personnel Manager, Century Works, Lewisham, London, S.E.13. 6134

ENGINEER required for experimental and development work on universal motors and domestic appliances. The work also involves some knowledge of airflow measurement and electronics, but versatility and ability to develop new ideas are of first importance. Applicants should have Higher National Certificate (Elect.) or equivalent, and preferably served an apprenticeship. Age 24 to 32. Write giving details of age, education and experience to—The Employment Officer, Hoover Limited, Perivale, Greenford, Middlesex. 5873

ENGINEER, preferably with electrical experience, required in an important executive capacity. Applicants, who would be responsible only to chairman and managing director, must possess first-class industrial mechanical experience. He would be engaged in the capacity of chief development engineer to a progressive firm of manufacturers whose works are located in the West of Scotland. Generous emoluments would be given to the right man. Applicants to state fully their experience, degrees (if any), quote references and salary expected, to—Box 6137.

ENGINEER required for the development of a wide range of fractional horse-power motors. Experience of this work and H.N.C. (elect.) or equivalent essential. Salary approximately £700 to start. Candidates, aged 25 to 35, should apply in writing, stating age, education, qualifications and experience, to—The Employment Office, Hoover Limited, Perivale, Middx. 5968

ENGINEERING laboratory assistant required for the development of a wide range of electrical test equipment. Salary minimum £11 5s. per week at age 25. Applicants should have H.N.C. (Elect.) and preferably served an engineering apprenticeship and have knowledge of electronics. Write giving details of age and experience to — The Employment Officer, Hoover Ltd., Perivale, Middlesex. 5872

ENGLISH ELECTRIC Co. Ltd., Stafford, have vacancies in their instrument division for sales and contracts engineers, preferably with H.N.C. or O.N.C. and some experience in this field. Good prospects of future outside representation. The positions offered are permanent, progressive and pensionable. Reply, in confidence, and quoting reference 1175E, to — Dept. C.P.S., 336/7, Strand, London, W.C.2. 6093

ESTIMATORS required by large electrical contractors in Scotland. Applicants must have sound practical and technical experience in the contracting field. Superannuation scheme with prospects. Write fully.—Box 6015.

EXPERIENCED storekeeper required by E.W.F. wholesaler at Bristol. Good wage offered to man capable of organising goods in transit and trade counter, etc.—Box 7707.

FIELDEN ELECTRONICS Ltd. require a number of young electronic and/or Instrument engineers for their technical sales divisions. Excellent prospects for keen young men. Write stating full particulars of education and previous experience to — The Sales Director, Fielden Electronics Ltd., Paston Rd., Wythenshawe, Manchester. 5972

G. S. PECKHAM & Co. requires experienced storekeeper able also to route van deliveries. Salary according to age and experience. Write —Mr. Peckham, 4, New Compton St., London, W.C.2. 6193

JUNIOR contracts engineers required by firm of consultants in their London office. Applicants must have had a good mechanical training and experience, preferably with large steam power plants and associated equipment. Duties will consist of the preparation of specifications, estimates and contract documents and also to assist in the execution of large engineering contracts from the design stage through to the completion of the work at site. Electrical experience will be an advantage. The salary offered will be according to experience and ability and the post is pensionable. Applicants must state fully their technical qualifications and give full particulars of training and experience which must be addressed to the Personnel Officer, Ewbank & Partners Limited, 10/11, Grosvenor Place, London, S.W.1. 6120

JUNIOR electrical engineer, age 21-23, H.N.C. electrical engineering preferred but not essential. Work involves preparation of electrical diagrams, specifications and technical correspondence in connection with all types of electric melting furnaces. Good conditions and prospects. Apply in writing to — Personnel Officer (MFD), Birlec Limited, Tyburn Road, Erdington, Birmingham, 24. 6138

JUNIOR electrical engineer required as assistant in section dealing with the design of power plant for telephone exchange contracts. Some knowledge of A.C./D.C. control circuits would be an advantage. Write giving full details of training and experience to — The Personnel Officer, Ericsson Telephones Limited, Beeston, Nottingham. 5831

JOINTERS required for aerodrome work in South-West England and Isle of Wight for up to 11-kV and telephone cables. Apply—Drake & Gorham (Contractors) Ltd., Pearl Assurance House, Royal Parade, Plymouth. 7737

KEEN young sales engineer required as Lancashire representative by manufacturers of all forms industrial m.v. switchboards, cubicles, control panels, substation switchboards, feeder pillars, etc., with full range heavy duty combination fused switches to 800 amps. and full industrial and domestic range of fusegear. Give details of experience in confidence to—Managing Director, Dennis Switchgear, Fleming Road, Speke, Liverpool. 5950

LAMP-making technicians required for work on incandescent lamps and filament development. Applications invited from young men 18-25 years old, with suitable experience, or for training, and should be addressed to—Lamp Engineering Dept., Thorn Electrical Industries Ltd., Lawrence Road, Tottenham, London, N.15. 6149

LIFT surveyors required in London area. Works and drawing office experience in lift manufacture particularly on electrical side. Technical training approximately Higher National Certificate standard. Age 26-30. Commencing £540, rising to £785. Non-contributory pension scheme and other staff advantages.—Box 6139.

MECHANICAL engineer required by cable works for production machine experimental and development work. Minimum qualification H.N.C. Age limits 30 to 40 years. The prospects are good and this is an opportunity for a man who likes to see the results of his ideas put into practice. Commencing salary according to qualifications and experience. Pension scheme. Apply in confidence, giving particulars in chronological order, to—Works Manager, Southern United Telephone Cables Ltd., Dagenham Dock, Essex. 6013

METROPOLITAN-VICKERS ELECTRICAL Co. Ltd., Trafford Park, Manchester, 17, have vacancies for servo engineers with some practical experience in electric servo and control circuit design and application. Qualifications required, a degree or Higher National Certificate. Applicants should not be less than 26 years of age. The posts are permanent and pensionable. Salary according to qualifications and experience. Apply in writing to the Personnel Manager, marking envelope "Servo Mechanisms." 215

PROCESS control staff. Assistants required for controlling manufacturing processes during production of high voltage paper insulated cables. Past experience not essential but mechanical engineering background advantageous. Ordinary or Higher National Certificate standard preferred and candidates must have completed National Service. Pension scheme. Canteen facilities. Reply, stating full background and salary required, to—B.I.C. (Submarine Cables) Ltd., c/o The Secretary, W. T. Glover & Co. Ltd., Trafford Park, Manchester, 17. 6121

PRODUCT development engineer. A prominent light engineering company in N.E. London area require a qualified engineer for design and development of automobile accessories. Experience in this field desirable but not essential. Commencing salary £1,000. Write giving details of qualifications and experience to—Box 6140.

REPRESENTATIVE required for London and Home Counties. Excellent existing turnover. Small van available 1st Jan. if necessary. Write or phone—Knightshades Ltd., Derby Rd., Edmonton, London, N.18. 6094

REPRESENTATIVE required for South of the Thames and London South Eastern Electricity Board area. Pension scheme in operation. Car owner preferred but not essential. Progressive position. Apply in strict confidence, giving full details of experience, age, salary, etc., to—Box 6017.

REPRESENTATIVES sought on good commission basis by well-known London manufacturers of electric lighting fittings. Established connection essential. Salary and expenses after trial period.—Box 6122.

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REPRESENTATIVE to cover Southern Electricity Board area. Applicants should be resident on the territory, have good contacts with architects, wholesalers and contractors, and possess their own car. This is an interesting and worthwhile post for a man with right background. Write in confidence to—The Sales Manager, M.K. Electric Limited, Wakefield Street, London, N.18. 6115

RESIDENT maintenance electrician required at Guy's Hospital, London, S.E.1. Experienced in A.C./D.C. generating equipment and general electrical engineering. Must have served recognised apprenticeship. Full trade rates, superannuation. Write or call — Chief Engineer. 6088

SALES engineer required by leading manufacturer of comprehensive range of industrial instruments and process control equipment for direct representation in the Birmingham area. Applicants should have good technical background and some flair for applications. Salary commensurate with qualifications and previous experience.—Box 5973.

SALES engineers, D.C. and A.C. motors and control gear, required London and Birmingham areas. Outside sales experience essential. —Box 5952.

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SENIOR and junior draughtsmen and laboratory technicians to undertake detail and development work with progressive company manufacturing electrical switch, fuse and motor control gear, etc. Applications should give full particulars of technical qualifications and previous posts and state salary required and be addressed to—Personnel Manager, Midland Electric Manfg. Co. Ltd., Reddings Lane, Tyseley, Birmingham, 11. 6176

SENIOR and junior draughtsmen required, with experience of power transformers. Experience on on-load voltage regulators an advantage. Good salary, rates above A.E.S.D. minimum, contributory pension scheme. Apply, stating age, experience and salary required, to —Brentford Transformers Ltd., Kidbrooke Park Road, London, S.E.3. 5832

SENIOR designs draughtsman. Must have some knowledge of drawing office practice in addition to varied design work associated with high-voltage switchgear. Applications giving particulars of age, experience and salary required to—Box 5996.

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TECHNICAL clerk to handle incoming orders in office of automatic temperature control manufacturer near London. Electrical background necessary. Age up to 50.—Box 5970.

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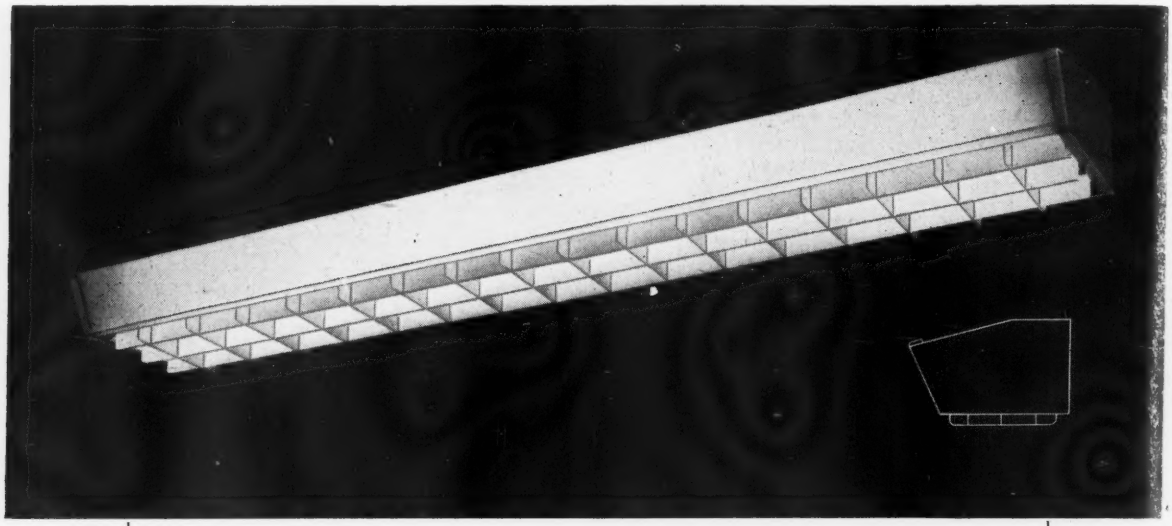

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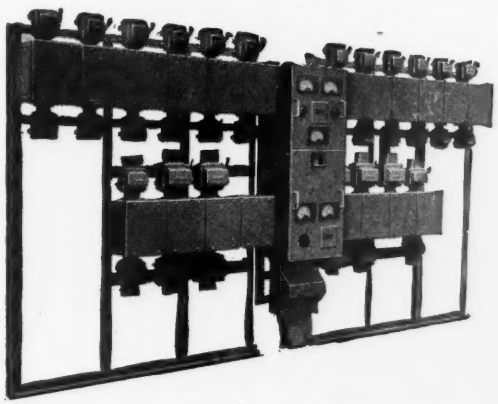

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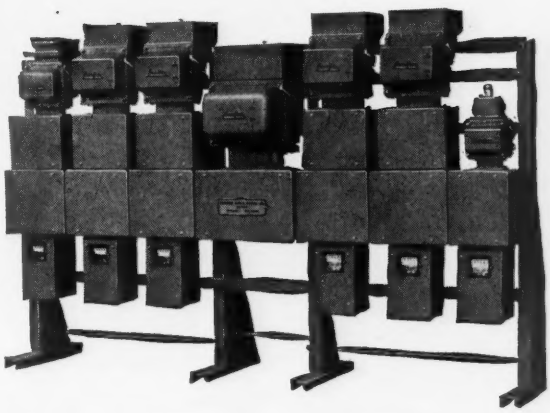

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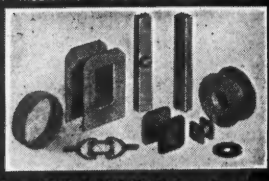

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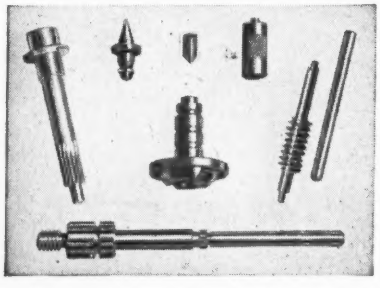

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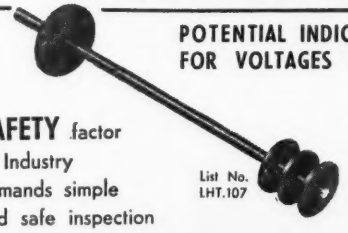

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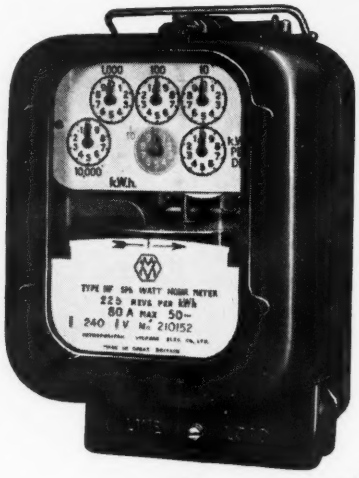

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